Devoted to the Generation, Distribution and Utilization of Energy

JOURNAL OF ELECTRICITY

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PERIODICAL DIVISION MAR 21 1917

"SHOULD AULD ACQUAINTANCE BE FORGOT"

(Incidents in the Life of the Engineer of the West not found in the formal Record of his Work)

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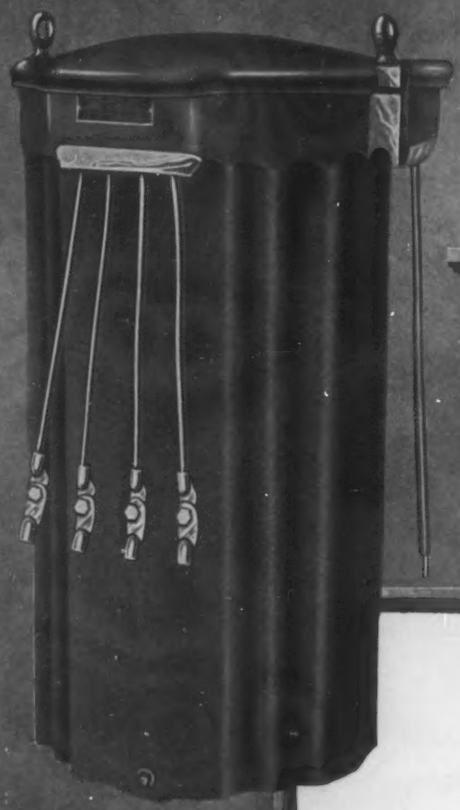

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JOURNAL OF ELECTRICITY

Devoted to the Generation, Distribution and Utilization of Energy

VOLUME XXXVIII SAN FRANCISCO, MARCH 15, 1917 NUMBER 6

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THE PROGRESS OF AMERICA IN TRADE AND FINANCE

BY JOHN CLAUSEN

(The engineer of the West, due to easy communication by water to all countries bordering the great Pacific, must of necessity keep himself well versed in the progress of America in trade and finance. In order to strengthen commercial and engineering relations with these countries, familiarity with the recently evolved Federal system of letters of credit, bills of exchange, commercial acceptances, bankers' sight drafts and commercial sight exchanges is of utmost importance. Here is a timely discussion of these points by the manager of the foreign department of The Crocker National Bank of San Francisco. Coming as it does from this well-known Western banking house, this contribution should prove of unusual interest to engineers of the West.—The Editor.)

An Arch Leading to a Commercial District in Peru

CONDITIONS are now peculiarly set for our merchants to increase their business with foreign countries, and, while it is fully appreciated that much of the trade which the rest of the world transacts with us at present is being diverted under compulsion, it behooves us to take what steps we can to establish intimate and satisfactory relations with these new customers that will assure continued trading even after our European contemporaries again enter the field of competition.

In the field of foreign trade there will be many articles which we cannot supply in competition with Europe, while on the other hand, by reason of our natural resources, there will be much we can advantageously produce and so create a vast and favorable commerce.

The Need for an American Merchant Marine.—It is a well recognized fact that the American merchant has been at a disadvantage in regard to shipping facilities which has proven a great handicap in building and picking up the trade now being neglected by our contemporaries in the Old World.

The situation relating to trade carrying facilities was far from satisfactory even in normal times, and our commercial expansion depended largely upon transportation offered by foreign carriers, which made it immeasurably more difficult after the European war was declared. From statistics it may be of interest to record that American ships carried less than 15 per cent of the $6,500,000,000 in merchandise imported and exported by the United States during the fiscal year of 1915-16.

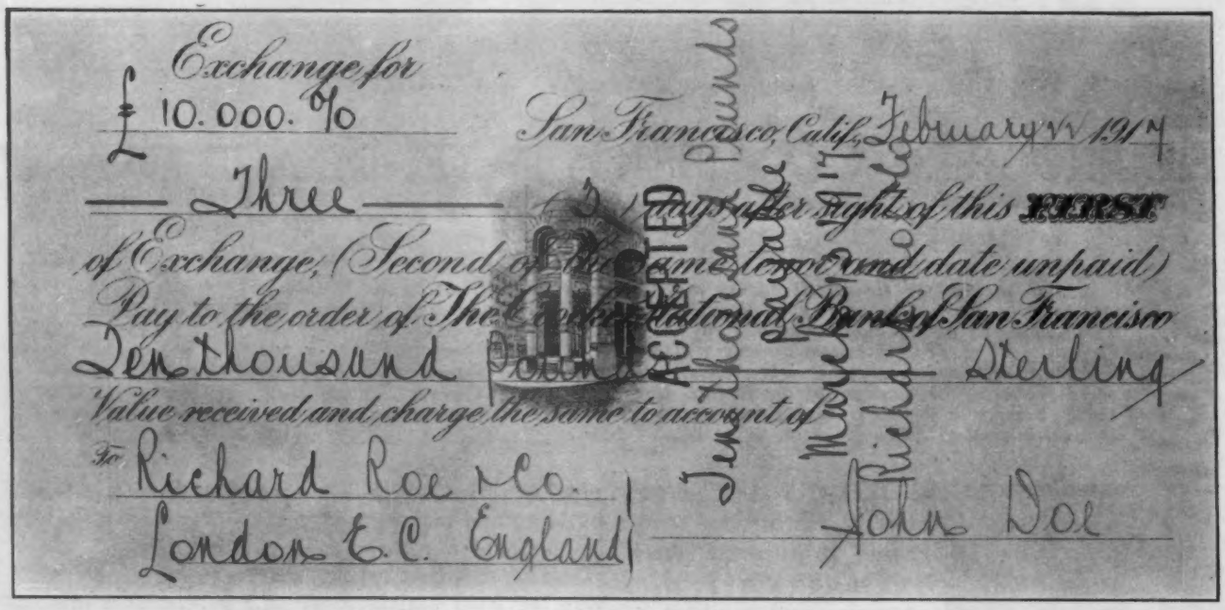
Unloading Transpacific Ships Without the Means of Wharves at Hong Kong—the Second Greatest Shipping Port in the World

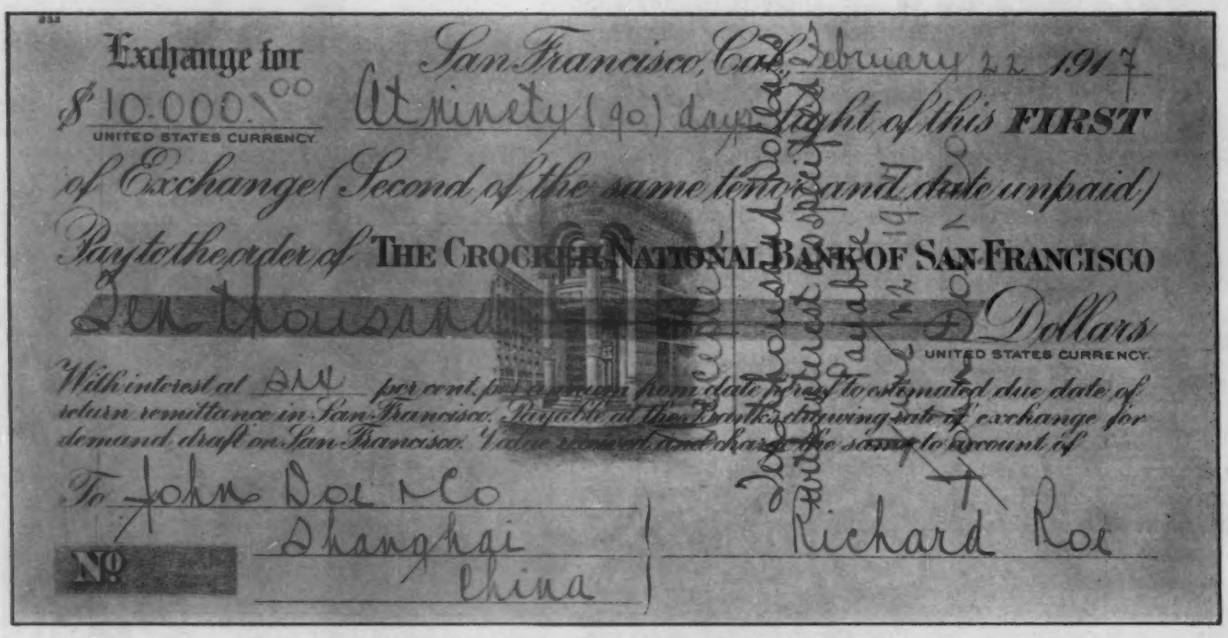
Obviously, a building up of a normal business activity is not to be expected until the usual channels of trade are opened and the many financial menaces removed.

Adequate Banking Facilities Essential.—Just as conditions differ in the various sections of the United States, so do we find a great diversity in systems and methods of operation in foreign countries. It becomes necessary for us to study these essential requirements in seeking adequate channels for expansion of our import and export trade and then arrange for the corresponding financial support to establish banking connections in caring for and promoting our business and financial interests.

We are all aware that there is an undoubted tendency on the part of our commercial element in an endeavor to enlarge the scope of functions performed by banks. It is possible that the conservatism natural and proper to bankers leads them to view such progressiveness too critically, but just as the conception of a banker's function has been vastly widened since the days of old, so the process will continue in the days that are to come. Developments of this kind are healthy, and wise men will not be disposed to obstruct them.

Commercial Acceptances in the Development of Trade.—The new bank act is essentially intended—as a commercial banking system—to assist in the financing of our internal and external trade and provide a market for commercial acceptances based upon the importation and exportation of goods—at the same time create a basic condition of automatic registra-


Exchange for
£ 10.000. %
San Francisco, Calif., February 22 1917
Three
of Exchange, (Second of the same tenor and date unpaid)
Pay to the order of The Crocker National Bank of San Francisco
Ten thousand Pounds Sterling
Value received and charge the same to account of
To Richard Roe & Co.
London E.C. England
John Doe
ACCEPTED
Ten thousand Pounds
March 22 1917
Richard Roe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UNITED STATES CURRENCY
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With interest at 8% per cent. per annum from date hereof to estimated due date of return remittance in San Francisco. Payable at the Bank's drawing rate of exchange for demand draft on San Francisco. Value received and charge the same to account of
To John Doe & Co
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Richard Roe
Ten thousand Dollars
March 22 1917
John Doe

Typical Commercial Acceptances on London, England, and Shanghai, China

tion of such operations, which is a very vital feature to prevent over-extension of credit. In the case of time bills of exchange drawn on and accepted by banks or bankers of high standing, there is practical uniformity of security—which cannot be claimed for "commercial paper" with which the financial markets here are supplied, the strength of such obligations depending upon the standing of miscellaneous commercial interests.

While we cannot hope to see the New York or San Francisco bill of exchange take the place of the so well and favorably known bills on London, Hamburg or Paris, recent events and dislocation of the financial structure in Europe have at least brought the possibility before the commercial world and tended to bring within our reach the power of competing on terms of equality with our European contemporaries.

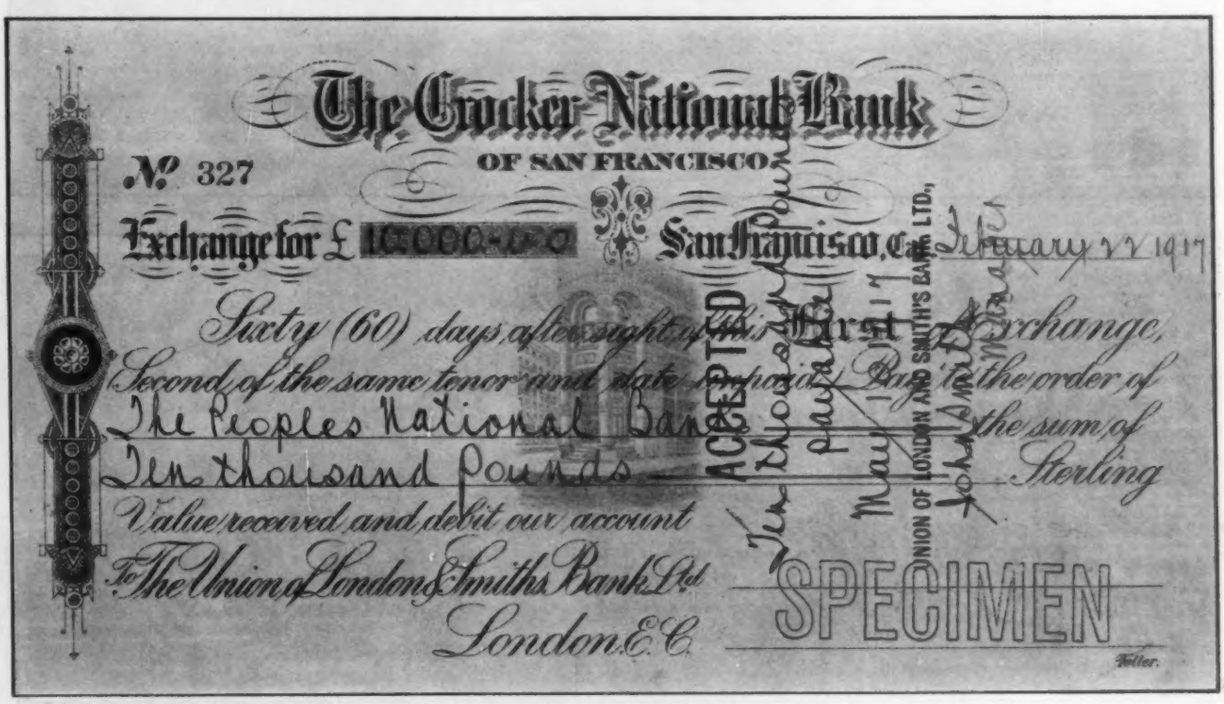
The power of a bank to accept a draft or bill of exchange enables it to make use of and to sell for a consideration its credit, and so lend, for legitimate use in trade, vast sums without depleting its reserve or impairing its capability in making additional loans and advances to its clients.

Whereas the act permits member banks to accept bills of exchange, they are not at present authorized to extend such facilities to clients for the acceptance of drafts covering domestic transactions, although a recent ruling of the Federal Reserve Board provides that where the funds resulting from acceptances are intended to produce the merchandise for ultimate export, or where such funds are to be applied to the purchase of goods to be shipped abroad from the United States, the acceptance privilege on the part of national banks can be invoked. The New York banking law gives permission to state banks and trust companies of extending these facilities for both foreign and domestic transactions. This is likewise the case in Maryland, Utah, Vermont and Texas—the latter restricted to foreign acceptances only—but the laws of other states carry no provision for banks extending to their customers the use of its credit in the development of commercial relations, and it would seem apparent that state bank legislation throughout the United States be amended to harmoniously conform to the new and better system.

A merchant, for instance, instead of borrowing cash on a note from his banker may arrange—for a stipulated commission charge—to use the bank's credit for a certain length of time and a given amount. To make use of such facilities a time-draft may be issued against the bank, which in turn gives the required acceptance. After this requisite has been secured the merchant is in position to either use the bill of exchange in the settlement of his trade obligations or sell it through a bill broker in the open market and so obtain available cash. The small merchant's paper—endorsed by his bank—is as acceptable as that of the largest merchant or corporation, backed as it is by security of the bank and therefore readily discountable by virtue of its high intrinsic security as the most liquid form of investment.

The world's commerce is almost in its entirety financed by bills of exchange, which in turn act as an index to the value of money. Increased trade, both domestic and foreign, very logically brings about a corresponding damand for credit, and while it may be comparatively easy to create credit, it is often a difficult matter to protect it, which, economically claimed, can only be done by maintaining an adequate amount of gold.

The Federal Reserve Bank, with its holding of "gold and lawful money," can, for this reason, very effectively find employment of its resources in fostering and rendering assistance in the financing of our trade, as also in the creation of a broader market in foreign centers for the American bank credit, and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OF SAN FRANCISCO
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Exchange for £ 10,000-0-0
San Francisco, Cal. February 22 1917
Sixty (60) days after sight of this First of Exchange,
Second of the same tenor and date unpaid Pay to the order of
The Peoples National Bank
Ten thousand Pounds
Sterling
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A Specimen Form of Banker's Acceptance

especially in the recognition of the United States dollar acceptance.

The Discount Market in Relation to Trade.—The matter of a ready discount market—comparing favorably with prevailing conditions in principal centers abroad—is worthy of very serious consideration, and while the feature of discount and rediscount provided for in the Federal Reserve Act may, in the main, be regarded as in the nature of a safety measure, it is hoped that as a principal aid to a more liberal system of financing our domestic and foreign trade, the American market may effectively adjust its rates to conform with those prevailing in other financial centers of the world. As an example of quotations from the discount market, the following is typical for such operations in New York:

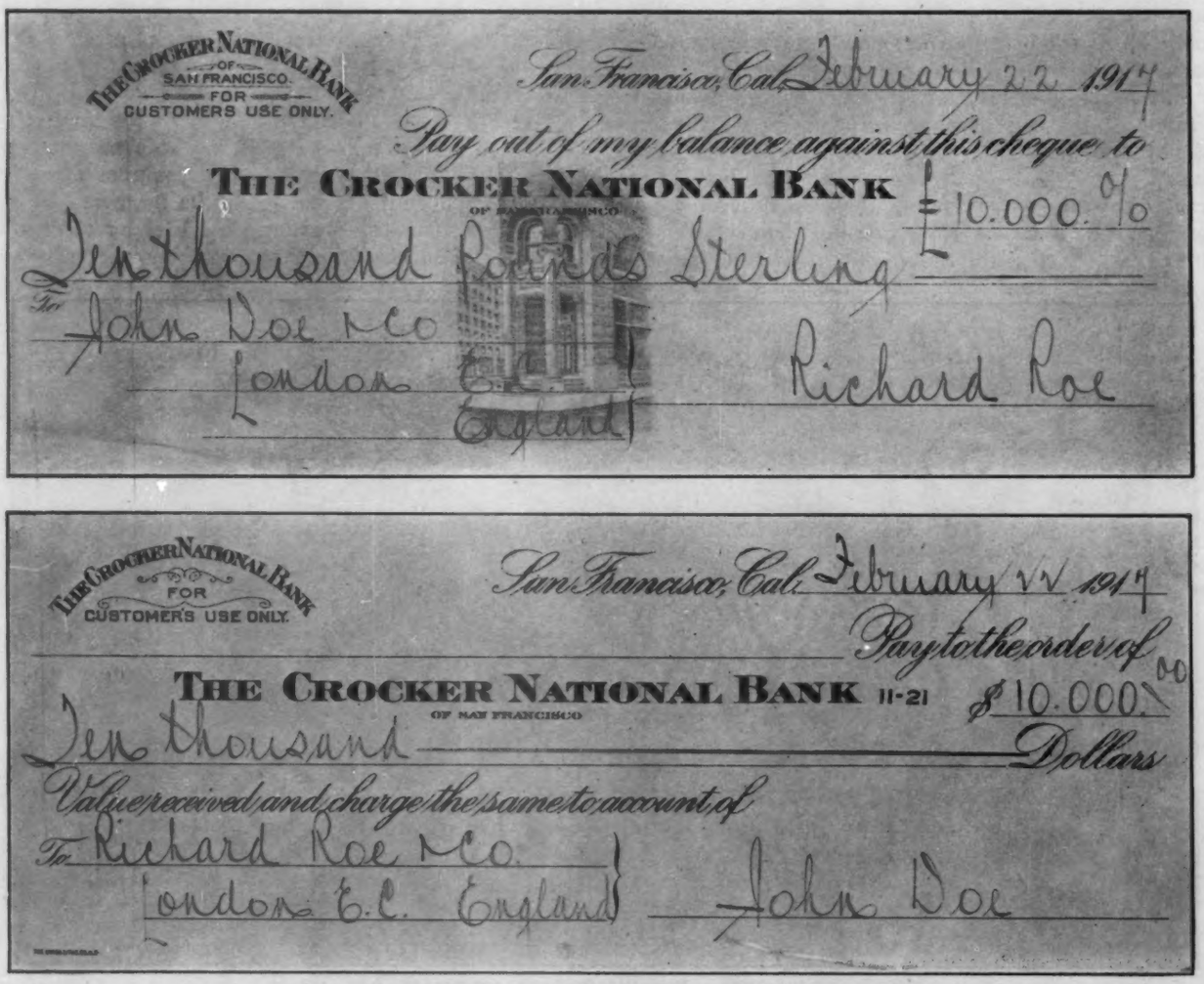
Of course, the value of money apart from the question of whether the open market rate of discount is slightly under or over the Federal Reserve Bank rate, will be governed by the strength of that institution, and the prospect of a demand upon its stock of gold reserve, as is the case with our British friends and their relations with the Bank of England.

Single name paper will not create a discount market as we find in London, Paris and Germany, where the fluctuations of rates so largely depend on the demand for and supply of marketable bills of exchange, which owe their origin to trade transactions as balanced against the demand for and supply of money. Low discount rates are an incentive to the revival of trade, and advancing rates in turn act as a natural check on trade and produce a gradual increase or decrease in the demand for money.

While these conditions are symptoms in governing the discount rates in Europe, our "call loan" rate as quoted in our Eastern markets only has an indirect relation to trade conditions, and registers mainly the speculative demand for stocks.

On the efficiency of the Federal Reserve Act must depend to a large extent the prospects of a great and favorable change in the international position of the United States which will now enter into the competitive field of operations of other great financial nations.

New York:	Last Week	Previous Week	Year to Date High	Year to Date Low	—Same Week— 1916	—Same Week— 1915
Call loans	2½@2	3 @2½	3	1¾	2¼@1¾	2½@1⅞
Time loans, 60-90 days	4½@4	4½@3¼	4½	2½	3 @2½	3 @2½
Six months	4½@4	5 @4	5	2¾	3¼@2¾	3½@3¼
Commercial discounts, 4-6 months	4½@4	4	4½	3	3½@3	4 @3½



Typical Banker's Sight Draft and Commercial Sight Exchanges

THE ANALYSIS OF DISCHARGE RECORDS

BY FRED F. HENSHAW

(The intelligent study of discharge records is of highest importance in hydroelectric development of water resources. Here is a timely discussion on this subject that will appear in three separate papers distinct in themselves, but which collectively cover all the essential features of methods of graphic analysis of discharge records. The author is district engineer of the U. S. Geological Survey at Portland, Ore., and these data are published in our columns by permission of the Director of the U. S. Geological Survey.—The Editor.)

The Water Resources Branch of the United States Geological Survey is the government bureau to which is delegated the measuring of streams and the investigation of water supply and run-off in the United States. This work has been increasing in scope and importance for more than 20 years, and records are now being secured at more than 1300 points, including over 900 west of the 95th meridian and between 500 and 600 on streams flowing into the Pacific Ocean.

The stream-discharge data collected by the Water Resources Branch are used and studied by the engineers of government departments, including the Land Classification Board, U. S. Reclamation Service, U. S. Engineer Office, by states, and by private individuals and corporations, such as power companies, and irrigation companies and districts. The object is to secure information that will be of the greatest value to such users and as complete as is consistent with accuracy.

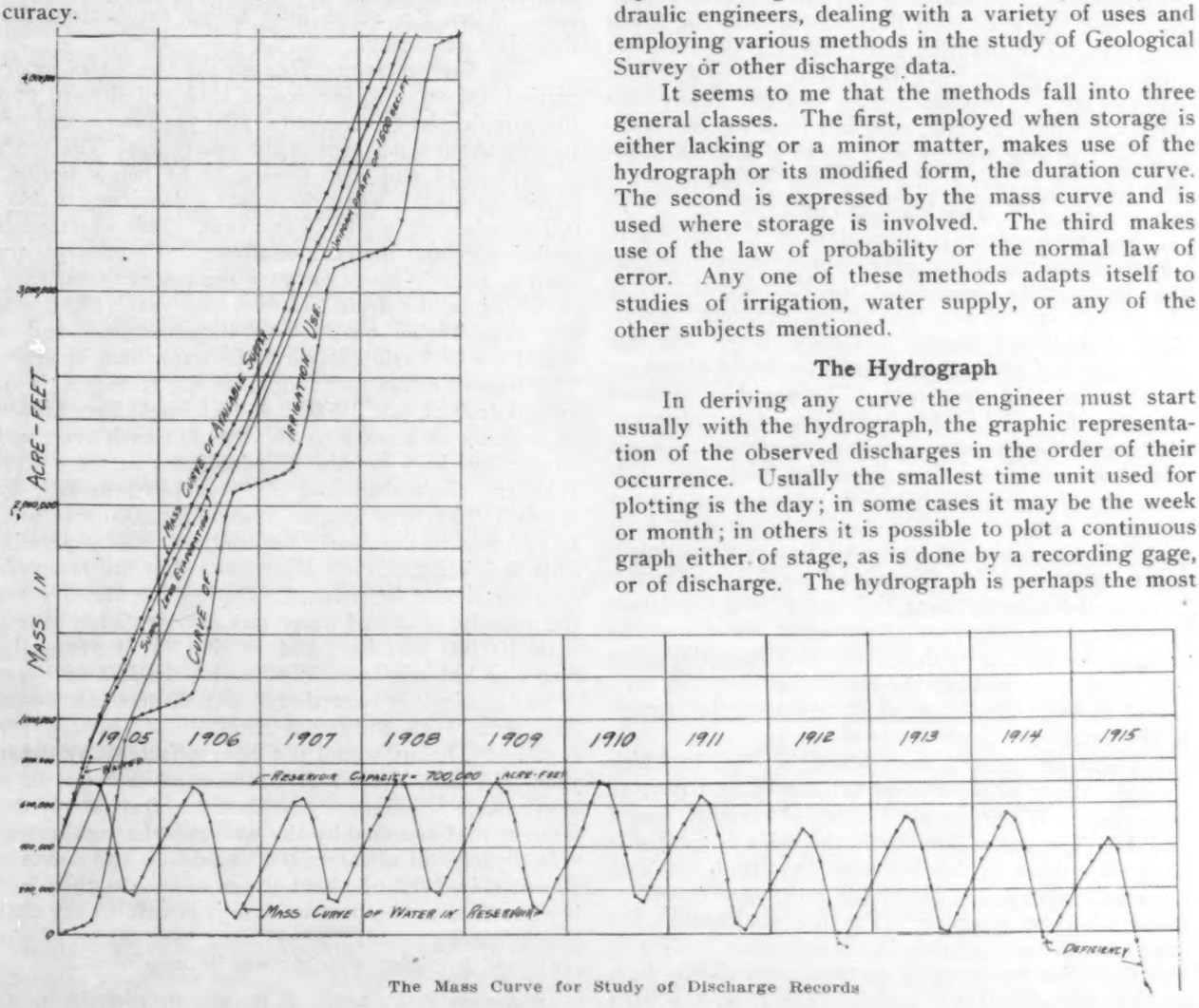
The purpose of this paper is to review briefly some methods of analysis used by engineers in studying the data as published by the Survey and to present some tentative conclusions on the sufficiency of such information for their needs, and not to consider its use in connection with operation for either power or irrigation. The study of past performances of a stream is presented as a guide to what may be expected in the future planning of new developments.

River-discharge data are analyzed in the study of various problems of water utilization, water power, irrigation, municipal supply, flood control, and navigation, which are probably noted in relative order of their present utility; that is, taking the United States as a whole, there are more studies made in the interest of water power than for any other purpose, those for irrigation being a close second. In preparing this report I have gone over a number of reports by hydraulic engineers, dealing with a variety of uses and employing various methods in the study of Geological Survey or other discharge data.

It seems to me that the methods fall into three general classes. The first, employed when storage is either lacking or a minor matter, makes use of the hydrograph or its modified form, the duration curve. The second is expressed by the mass curve and is used where storage is involved. The third makes use of the law of probability or the normal law of error. Any one of these methods adapts itself to studies of irrigation, water supply, or any of the other subjects mentioned.

The Hydrograph

In deriving any curve the engineer must start usually with the hydrograph, the graphic representation of the observed discharges in the order of their occurrence. Usually the smallest time unit used for plotting is the day; in some cases it may be the week or month; in others it is possible to plot a continuous graph either of stage, as is done by a recording gage, or of discharge. The hydrograph is perhaps the most



The Mass Curve for Study of Discharge Records

expressive curve to the layman that can be drawn. It is the simplest to derive and to comprehend. For many of the more elementary studies the hydrograph is all that is required. On the same graph with it can be shown the curves of water demand or use, and the difference between the two curves shows the excesses or deficiencies lineally in terms of rate of flow or by areas representing the total quantities of water that can be stored or that must be supplied from storage to obviate deficiencies.

The Duration Curve

The curve of duration is derived from the hydrograph by arranging the terms in order of magnitude instead of in order of occurrence. This is usually done for a period of one year, and the graphs for successive years may be superimposed on the same sheet just as the hydrograph for several years may be shown. Such a curve adapts itself especially well to the study of possible power development where storage is lacking, and where it is feasible to market a considerable amount of second-class power or power available for only a part of the year and that can be sold for such a period. It is also of as much value, at least, as a mass curve in cases where a limited amount of storage is available. The storage capacity required to maintain any discharge value may be represented by the area, roughly triangular in shape, between the duration curve and the horizontal line representing the given discharge. The duration curve may be used also in studies of irrigation from the natural flow of a stream that can not be supplemented by storage. Many conditions of crops, climate, soil, and land values justify the use for irrigation of water which may be available for only a part of the irrigating season.

The Mass Curve

The mass curve is derived from the successive summation of the discharges shown in the hydrograph; that is, it is the integral of the hydrograph. It is shown in terms of total quantities, acre-feet, or millions of cubic feet, instead of rates of flow. The rate of flow at any given time is represented by the slope or differential of the curve. The simplest of mass curves is formed by the summation of the observed discharge. This has, of course, a continuous upward direction, varying in slope with the discharge. Underneath this can be drawn a line representing the use of water—either a straight line typifying a uniform draft, as for power, or a curved line representing a non-uniform draft, as for irrigation. The difference in vertical height between the two curves represents the storage in reservoir. This mass curve may be modified by measuring down the draft from the curve of run-off, thus making the height between the horizontal axis and the lower graph represent the storage in the reservoir.

These curves are exemplified in Fig. 1, which shows a study of the run-off of Deschutes River, as presented in Water-Supply Paper 344,[1] brought down to 1915. The upper line shows the mass of river discharge corrected in this instance for certain assumed diversions above. A correction has been made for evaporation on reservoir. The line underneath the mass curve shows supply less evaporation. Next is a straight line representing an assumed uniform draft of 1500 second-feet for power. This line has been drawn with the assumption that 200,000 acre-feet of water is stored in the reservoir at the start. The vertical distance between the lines at any point indicates the volume of storage. Thus it is shown that to have conserved all surplus and supplied all deficiencies on the basis of 1500 second-feet continuous flow the reservoir would have filled to about 340,000 acre-feet at the end of May, 1905, and would have been depleted to about 70,000 acre-feet at the end of March 1907. The net storage used to carry over this period of deciency would have been about 270,000 acre-feet. Underneath the straight line showing the uniform draft is a curved line indicating the varying rate of use of irrigation water throughout the successive seasons. In the winter only a small flow is required for domestic and stock water; the heaviest draft comes in June, July and August. The distance between this graph and the second graph shows again the quantity of water in the reservoir. As previously stated, it serves the purpose better to subtract the monthly use from the monthly supply, and secure a curve showing directly the volume in the reservoir, or the bottom curve in the diagram. The lowest horizontal line represents zero storage or reservoir empty. The line of 700,000 acre-feet has been assumed to represent reservoir capacity. The volume in reservoir fluctuates between these lines. When the graph goes over the upper one water is wasted as indicated by a dotted line. When the graph goes below the bottom line there is a deficiency.

The diagram as prepared for the Deschutes report carried the curve to the end of 1912 and showed that the only deficiency occurred in that year and amounted to only about 6 per cent of the yearly use. The years of 1913, 1914 and 1915 proved to be below normal, particularly 1915, when there was a deficiency of 288,000 acre-feet or nearly 28 per cent. This shortage is probably greater than can be allowed. Two courses are open to remedy it—to increase the reservoir capacity, or to reduce the draft. In only one year (1904) was any considerable quantity of water wasted, and it would not be feasible to carry the water over 11 years. The reservoir was last full in 1910. A reduction of annual draft of, say, 25,000 acre-feet would have caused an increase in storage by this amount each year, and would thus have reduced the deficiency at the end of 1915, the sixth year after the reservoir was full, by nearly 150,000 acre feet, or to about 138,000 acre feet, 14 per cent of the yearly use and an entirely permissible deficiency. Study also shows that the reservoir capacity should be reduced. During the first 6 years the quantity of stored water was never reduced to less than 100,000 acre-feet, and in the last 4 years the reservoir has not been filled within 150,000 acre-feet of its capacity. A reduction of 100,000 acre-feet would have caused an additional shortage of about 8 per cent in 1911, but would not have affected any other year. In fact, the U. S. Reclamation Service, in a study made subsequently, assumed a draft about the same as that assumed by the writer, and a total reservoir capacity of about 550,000 acre-feet, and found a shortage in 1912 of about 9 per cent. If this had been carried to the present date it is safe to say that the deficiency in 1915 would have been 20 to 25 per cent, which might or might not be safe.

[1] Henshaw, F. F., Lewis, J. H., and McCaustland, E. J., Deschutes River, Ore., and its utilization: U. S. Geol. Survey Water-Supply Paper 344, 1914.

MILITARY TRAINING FOR ENGINEERS

BY J. D. GALLOWAY AND ALLEN G. JONES

(The solemn scene through which the nation is passing has caused engineers of the West to think more seriously than ever on the probable service each could render to the country in the event of war. This mental activity has crystallized in and about San Francisco, California, in the formation of a course of study whereby engineers may prepare for the Officer's Reserve Corps of the United States Army. The plans thus far matured, detailed below, will undoubtedly receive thoughtful consideration by engineers in all sections of the West.—The Editor.)

A NEW COURSE OF STUDY FOR ENGINEERS TO PREPARE FOR THE OFFICERS' RESERVE CORPS

A joint committee on military affairs of the San Francisco branches of the American Institute of Mining Engineers, American Institute of Electrical Engineers, American Society of Civil Engineers, and the American Chemical Society having received about one hundred and fifty favorable replies from the membership of these branches, are now organizing a complete series of lectures that will open to all engineers and others interested in an officers' reserve corps of the United States Army. J. D. Galloway is chairman and Allen G. Jones is secretary of this committee, to whom all communications should be addressed.

The Joint Committee on Military Affairs recently mailed to the local members of the engineering societies a circular of information regarding the Officers' Reserve Corps of the United States Army, with special reference to (4) Coast Artillery; (9) Quartermaster; (10) Engineer; (11) Ordnance and (12) Signal Corps. It was announced that if a sufficient number of engineers were interested, a study and lecture course would be initiated by this committee, as a preparation for the examinations for commissions in the reserve corps. From the favorable replies that have been received the committee feels justified in proceeding.

Lectures Open to all Engineers and Others Interested

A circular is being sent to all engineers affiliated with the local or National Societies and to other engineers not so affiliated whose addresses are available. The study and lecture course is not confined to those who have already sent cards, but is open to all engineers and to others who may be interested. The courses as planned relate to branches of the service in which engineers would be interested, but if a sufficient number of persons indicate a desire for instruction in other branches of the service, such as infantry or cavalry, special courses of study will be arranged in those branches.

Plan of the Course.—As it was probable that the engineers might be interested in any one of the five different corps named above, arrangements have been made for special instruction therein, but, as certain requirements of the examination are common to all corps, the first lectures are general in their nature applying to all arms and should be attended by all.

The text specified under each course should be studied by a candidate prior to attending lectures.

General Subjects: Lecture Course "A." To be taken by everyone interested.

First Lecture

Lecturer: Major General J. Franklin Bell, commanding Western Department, U. S. Army.
Subject: The United States Army and its Officers and Enlisted Reserve Corps.
Hour and Date: 8 o'clock p. m., Tuesday, March 13, 1917.
Place: Native Sons of the Golden West Bldg., 430 Mason street, San Francisco.
Text: Fundamentals of Military Service.

Second Lecture

Lecturer: Capt. R. Park, Corps of Engineers.
Subject: General Duties of the Different Arms of the Service.
Hour and Date: 8 o'clock p. m., Tuesday, March 20, 1917.
Place: Native Sons of the Golden West Bldg., 430 Mason street, San Francisco, Cal.
Text: Fundamentals of Military Service.

Third Lecture

Lecturer: To be announced.
Subject: Administration of the U. S. Army.
Hour and Date: 8 o'clock p. m. Tuesday, March 27, 1917.
Place: Native Sons of the Golden West Bldg., 430 Mason street, San Francisco, Cal.
Text: Army Regulations, Edition 1913, Articles 1-23, 29-33, 39, 40, 53, 55, 60; also special articles pertaining to the different corps—Field Service Regulations, Part III.

Fourth Lecture

Lecturer: Captain George M. Marshall, A.D.C. to General Bell.
Subject: Field Service Regulations.
Hour and Date: 8 o'clock p. m., Tuesday, April 3, 1917.
Place: Native Sons of the Golden West Bldg., 430 Mason street, San Francisco, Cal.
Text: Field Service Regulations U. S. Army.

Fifth Lecture

Lecturer: Captain George M. Marshall, A.D.C. to General Bell.
Subject: Infantry Drill Regulations—Small Arms Firing Regulations.
Hour and Date: 8 o'clock p. m., Tuesday, April 10, 1917.
Place: Native Sons of the Golden West Bldg., 430 Mason street, San Francisco, Cal.
Text: Infantry Drill Regulations U. S. Army.

Sixth Lecture.

Lecturer: To be announced.
Subject: Military Law.
Hour and Date: 8 o'clock p. m., Tuesday, April 17, 1917.
Place: Native Sons of the Golden West Bldg., 430 Mason street, San Francisco, Cal.
Text: Manual of Courts Martial. General Orders, No. 4 and No. 52, 1902, A.G.O. Circular No. 65 W.D., 1907, Rules of Land Warfare.

Seventh Lecture

Lecturer: Capt. R. Park, Corps of Engineers.
Subject: Topography.
Hour and Date: 8 o'clock p. m., Tuesday, April 24, 1917.
Place: Native Sons of the Golden West Bldg., 430 Mason street, San Francisco, Cal.
Text: Engineer Field Manual U. S. A., Part 1.
Note: On or before the conclusion of the General Lecture Course, members will please send in to the Military Affairs Committee a statement of the special course which they desire to attend.

SPECIAL SUBJECTS

On conclusion of the General Lecture Course "A." the following Special Lectures will be given, provided a sufficient number of persons elect to take the courses. Information regarding place, time, the lecturers and texts will be announced later.

LECTURE COURSE "B"

Of value to candidates for commissions in the Coast Artillery Corps.

First Lecture

Lecturer: Captain John B. Murphy, Coast Artillery Corps, A.D.C.
Subject: Coast Artillery Drill.
Text: Coast Artillery Drill Regulations.
(For other lectures, see courses "F" and "G" below.)

LECTURE COURSE "C"

Of special value to candidates for commissions in the Quartermaster Corps.

First Lecture

Lecturer: Lt. Col. Thomas H. Slavens, Dept. Quartermaster.
Subject: General Quartermaster duties and business.

Second Lecture

Lecturer: Lt. Col. Thomas H. Slavens, Dept. Quartermaster.
Subject: Transportation: Land and Water: Hippology.

LECTURE COURSE "D"

Of special value to candidates for commission in the Signal Corps.

First Lecture

Lecturer: Captain Leroy Muller C. A. C.
Subject: Aviation.

Second Lecture

Lecturer: First Lieutenant D. B. Sanger, Signal Corps Dept. Signal Officer.
Subject: Signalling, telegraphy, telephony.

LECTURE COURSE "E"

Of special value to candidates for commission in the Ordnance Department and the Coast Artillery.

First Lecture

Lecturer: Major H. W. Schull, Dept. Ordnance Officer.
Subject: Duties of Ordnance Officers.

LECTURE COURSE "F"

Of special value to candidates for commission in the Ordnance and Coast Artillery.

First Lecture

Lecturer: Major H. W. Schull, Dept. Ordnance Officer.
Subject: Mechanical Engineering and Machine Work.

Second Lecture

Lecturer: Captain John B. Murphy, Coast Artillery Corps.
Subject: Electrical Engineering and Electricity as Applied to the Coast Artillery Corps.

Third Lecture

Lecturer: Captain John B. Murphy, Coast Artillery Corps.
Subject: Explosives, Primers and Fuses.

LECTURE COURSE "G"

Of special value to candidates for Coast Artillery Corps, Signal Corps, and Engineer Corps.

First Lecture

Lecturer: Captain R. Park, Corps of Engineers, Assistant to Department Engineer.
Subject: Duties of engineer officers and proper co-operation between various arms of the Service—Search Lights—Field Fortifications.
Text: Engineer Field Manual—Technique of Modern Tactics, Chapters 8, 9, 11, 12—Bulletin No. 4, Vol. 1, O.C.S.

Books

The following books are recommended by the office of the Chief of Engineers:

U. S. Army Regulations, 1913, Supt. of Documents, Washington, D. C.	$ .50
Military Railways, Professional Papers No. 32, Corps of Engineers, Supt. of Documents, Washington, D. C.	.50
Field Service Regulations, Supt. of Documents, Washington, D. C.	.60
Infantry Drill Regulations, Supt. of Documents, Washington, D. C.	.35
Manual of Courts Martial, Supt. of Documents	1.00
Engineers Field Manual, Supt. of Documents, Washington, D. C.	1.00
Bulletin No. 4, Vol 1, O.C.S., Adjutant General, U. S. Army, Washington, D. C.	Free
General Order No. 6, 1915, Adjutant General, U. S. Army, Washington, D. C.	Free
General Order No. 52, Adjutant General, U. S. Army, Washington, D. C.	Free
Circular No. 65. War Dept., 1907	Free
Fundamentals of Military Service, Andrews Army Service Schools, Book Dept., Fort Leavenworth, Kansas	1.50
Technique of Modern Tactics, Army Service Schools, Book Dept., Fort Leavenworth, Kansas	2.65
Notes on Field Fortifications, Army Service Schools, Book Dept., Fort Leavenworth, Kansas	.30
Studies in Minor Tactics, Army Service Schools, Book Dept., Fort Leavenworth, Kansas	.50

For those who contemplate commissions as 1st and 2d lieutenants, "Field Service Regulations," 60c.; "Infantry Drill Regulations," 35c.; and "Fundamentals of Military Service," $1.50, a total of $2.45, together with Orders and Circulars, will probably be sufficient. For those who contemplate commissions as captain or major, "Technique of Modern Tactics," $2.65, added to the above will probably be sufficient. If possible, the entire set should be obtained.

The committee will obtain any of these books, provided a request accompanied by the price is sent in by March 1, 1917. If a sufficient number of books are ordered at one time the Army Service Schools, Book Department will give a discount of 20 per cent, on their publications only. The "Fundamentals of Military Service" can be obtained from Technical Publishing Company, Crossley Bldg., San Francisco, who will give a 10 per cent discount.

Expenses

The only cost additional to the above for books will be $1.50 for each one taking the course, to cover expenses of printing, postage, hall rent, stenographer, etc. Make checks payable to the Military Affairs Committee.

Correspondence Course

In the original circular a statement was made of a possible correspondence course. The number of replies received does not warrant this action. Engineers who cannot attend the lectures may, however, by following the reading announced, prepare themselves for the examinations. The committee will obtain books at cost and will endeavor to answer questions.

VAST SHIPBUILDING ON PACIFIC COAST

The Launching of the Thordis in Oakland

THE ever-increasing activity of ship-building on the Pacific Coast is daily drawing the attention of engineers of the West to the electrical possibilities of the future in this phase of commercial development. Much has appeared in the technical press relative to the general proportions of this awakened industry. Little has been published, however, in the way of specific listings of the present status of actual ships now under construction.

In much of this new building electric and turbine operation will find new applications. The Maui, for instance, which is now building at the Union Iron Works in San Francisco, is being installed with geared turbine propelling machinery and will be the first large passenger vessel in this country so equipped. Most of the vessels thus far equipped with geared turbines have been single screw and of comparatively small power—from 2000 to 3000 horsepower, whereas this installation is twin screw and will develop 10,000 h.p. at full speed. At a later date there will appear in the columns of the Journal detailed descriptions of many of these new and interesting achievements in marine engineering now being brought about in Pacific Coast ship yards.

From government commerce reports the total tonnage in shipbuilding now under way in the United States is as follows:

Kinds.	Number.	Gross tons.
Steel merchant ships	403	1,495,601
Wooden merchant ships	161	207,623
Total merchant construction	564	1,703,224
		Displacement, tons.
Government vessels: Steel, navy yards and private yards	118	395,537
Grand total	682	2,098,761

The Pacific Coast is well represented in this activity and the increased uses of electrical applications in modern marine service make the statistics of shipbuilding on the Pacific Coast of unusual interest to engineers of the West. In detail the work now under way is as follows:

Seattle Construction & Dry Dock Co., Seattle, Wash

Vessel	Gross Tonnage	Speed Knots	Merchant Vessels Owner	Trade	Probable Date of Launch
Panuco	3,900	12	New York & Cuba Mail Steamship Co.	Cargo	Launched
No. 88	7,500	..	A. O. Andersen & Co., Den.	Cargo	Feb 1, 1917
No. 89	7,500	..	A. O. Andersen & Co., Den.	Cargo	Apr 1, 1917
No. 90	7,500	..	A. O. Andersen & Co., Den.	Cargo	Mar 1, 1917
Walter A. Luckenbach	8,000	12	Edgar F. Luckenbach	Cargo	Apr 1, 1917
No. 92	4,800	10½	For Norwegian account	Cargo	May —, 1917
No. 93	4,700	10½	For Norwegian account	Cargo	Late 1917
No. 94	4,700	10½	For Norwegian account	Cargo	Late 1917
No. 95	4,700	10½	For Norwegian account	Cargo	Late 1917
No. 96	4,700	10½	For American account	Cargo	Late 1917

Vessel	Displacement Tons	Speed Knots	War Vessels Type	Contract Price	Probable Date of Completion
Gwin	1,123	30.0	Destroyer	$ 885,000	Nov. 8, 1917
N-1	....	....	Submarine	450,000	May 19, 1917
N-2	....	....	Submarine	450,000	June 19, 1917
N-3	....	....	Submarine	450,000	July 19, 1917
Scout Cruiser No. 4	7,100	35.0	Scout cruiser	4,975,000	June 26, 1919

INTERSTATE BRIDGE SPANNING COLUMBIA RIVER, WITH FULL ALLOWANCE FOR NEW SHIPPING INDUSTRY

The great structure built by the people of Clarke County, Washington, and Multnomah County, Oregon, to facilitate traffic between the two states and form a connecting link in the Pacific highway, is opened. General view (above) of the bridge over the main channel of the Columbia. This section contains 14 spans and is 3530 ft. long. The structure is really three bridges, with total length of 17,300 ft. It consists of a main bridge over the Columbia, a bridge over the Columbia Slough and a bridge over the Oregon Slough. The cost was $1,750,000, of which Clarke County paid $500,000 and Multnomah County $1,250,000. The total weight of steel in the structure is 16,696,000 pounds.

Union Iron Works Co., San Francisco

Merchant Vessels

Vessel	Gross Tonnage	Speed Knots	Owner	Trade. Cargo and Passenger	Probable Date of Launch Launched
Maui	9,728	16	Matson Navigation Co	Bulk Oil	Launched
J. W. Van Dyke	7,200	11	Atlantic Refining Co	Cargo	Feb. —, 1917
Southerner	6,200	11	Walker-Armstrong Co	Cargo	Feb. 15, 1917
Annette Rolph III	6,200	11	Rolph Navigation & Coal Co	Bulk Oil	July —, 1917
Fred W. Weller	10,500	11	Standard Oil Co., of New Jersey	Bulk Oil	Aug. —, 1917
A. C. Bedford	10,500	11	Standard Oil Co., of New Jersey	Cargo	Jan. —, 1917
Eagle	6,200	11	Standard Transportation Co	Cargo	Feb. 25, 1917
Tiger	6,200	11	Standard Transportation Co	Cargo	Launched.
Talabot	6,200	11	N. S. Bjonnes & Son, Nor	Cargo	Jan. 30, 1917
No. 139	6,200	11	Christian Smith, Nor	Bulk Oil	June 15, 1917
No. 140	7,200	11	Wilhelm Jebsen, Nor	Bulk Oil	Apr. 15, 1917
No. 141	7,200	11	Pan American Petroleum & Transport Co	Cargo	June —, 1917
No. 142	6,200	11	Not given	Bulk Oil	June 26, 1917
No. 143	7,200	11	Atlantic Refining Co	Bulk Oil	July 22, 1917
No. 144	7,200	11	Atlantic Refining Co	Bulk Oil	Aug. 17, 1917
No. 145	7,200	11	Pan American Petroleum & Transport Co	Bulk Oil	Sept. —, 1917
No. 146	7,200	11	Pan American Petroleum & Transport Co	Bulk Oil	Dec. —, 1917
No. 147	7,200	11	Not given	Bulk Oil	July —, 1917
No. 148	7,200	11	Atlantic Refining Co	Bulk Oil	Sept. —, 1917
No. 149	7,200	11	Atlantic Refining Co	Cargo	May 20, 1917
No. 150	5,950	11	Not given	Cargo	June 20, 1917
No. 151	5,950	11	Not given	Floating Dry Dock	*Jan 5, 1917
No. 152	....	..	Builder's account	Cargo	Dec —, 1917
No. 153	6,200	11	Not given	Cargo	Sept —, 1917
No. 154	3,600	9½	A. O. Lindvig, Nor	Caisson for Floating Dry Dock	
No. 155	....	..	Builder's account	Cargo	Jan —, 1917
At Alameda yard:				Cargo	Mar 30, 1917
No. 16	3,600	9½	C. H. Smith, Nor		
No. 17	3,600	9½	Willy C. Gilbert, Nor		

*Launched.

California Shipbuilding Co., Long Beach, Cal

L-6			Submarine	$560,000	Apr 1, 1917
L-7			Submarine	560,000	May 1, 1917
O-14			Submarine	548,500	Mar 1, 1918
O-15			Submarine	548,500	Apr 1, 1918
O-16			Submarine	548,500	May 1, 1918

Moore & Scott Iron Works, Oakland, Cal

Therdes	5,000	..	O. T. Tvennerald, Norway	Cargo.	Launched July —, 1917
No. 111	6,000	..	Huasteca Petroleum Co	Bulk Oil	July 1, 1917
No. 112	4,600	..	For Norwegian account	Cargo	July 1, 1917
No. 113	5,000	10½	For Norwegian account	Cargo	June —, 1917
No. 114	5,000	10½	For Norwegian account	Cargo	July —, 1917
No. 115	5,000	10½	For Norwegian account	Cargo	Oct. —, 1917

Skinner & Eddy Corporation, Seattle, Wash

No. 3	6,400	10½	Standard Oil Co. of New Jersey	Bulk Oil	Feb —, 1917
No. 4	6,400	10½	Standard Oil Co. of New Jersey	Bulk Oil	May —, 1917
No. 5	5,730	11½	Builder's Account	Cargo	Feb. —, 1917
No. 6	5,730	11½	Builder's account	Cargo	June —, 1917
No. 7	5,730	11½	Not given	Cargo	Aug —, 1917
No. 8	5,730	11½	Not given	Cargo	Nov —, 1917
No. 9	5,730	11½	Not given	Cargo	Dec —, 1917
No. 10	5,730	11½	Not given	Cargo	Dec —, 1917
Elizabeth Gibbs	5,730	..	Not given	Cargo	Spring 1918

J. F. Duthie & Co., Seattle, Wash

No. 8	5,730	10½	Torpe & Weise, Nor.	Cargo	Summer 1917
No. 9	5,730	10½	Peder Kleppe, Nor.	Cargo	Summer 1917
No. 10	5,730	10½	Willy Gilbert, Nor	Cargo	Summer 1917
No. 11	5,730	10½	Lauritz Kloster, Nor.	Cargo	Fall 1917.
No. 12	5,730	10½	Lauritz Kloster, Nor.	Cargo	Fall 1917.
No. 13	5,730	11	For Norwegian account	Cargo	Fall 1917.
No. 14	5,730	..	For Norwegian account	Cargo	1918 delivery.

Albina Engine & Machine Works, Portland, Ore

No. 1	3,300	10	Ragnvald Jacobsen, Nor.	Cargo	Aug —, 1917
No. 2	3,300	10	Rederelaktiebolegat Altran, Falkenburg, Swe	Cargo	Oct —, 1917
No. 3	3,800	12	S. S. Co., Viking, Den	Cargo	Dec —, 1917
No. 4	3,800	12	S. S. Co. Skjold, Den	Cargo	Mar —, 1918
No. 5	3,800	12	S. S. Co. Carl, Den	Cargo	May —, 1918
No. 6	3,800	12	S. S. Co., Gorm, Den	Cargo	July —, 1918

Anderson Steamboat Co., Seattle, Wash

———	5,700	10½	Hannevig Bros., Nor	Cargo	.....
———	5,700	10½	Hannevig Bros., Nor	Cargo	.....

TIME PHENOMENA OF INTEREST TO ENGINEERS

(In the issue of February 15, 1917, under the column headed Sparks, there appeared a statement that, although the net increase in the day begins on December 21 each year, still the sun does not begin to rise earlier until ten days later. Due to the present nation-wide discussion devoted to setting clocks ahead an hour, a brief review of the astronomical explanation of the phenomena above alluded to should prove interesting and instructive to readers of the Journal. Here are two letters, one from the students observatory at Berkeley and the other from the director of the great Lick Observatory at Mt. Hamilton, which should entirely clarify the matter.—The Editor.)

Sir:—The statement is correct. The sun does not begin to rise earlier until about the 9th of January, but it sets from one to two minutes later during this interval giving a continually increasing length of duration of daylight. The reason is due to what is technically called the "Equation of Time." Civil time is not regulated according to the true sun, but according to a fictitious body called the mean sun which is assumed to move along the equator at a uniform daily rate. The motion of the true sun is non-uniform, owing to the eccentricity of the earth's orbit, and also to the fact that it moves on the ecliptic and not on the equator.

Following the 21st of December the true sun is moving easterly with respect to this mean sun, so that the clock time (civil time) of the rising of the true sun becomes later daily owing to this fact; but on account of the true sun coming north then there is a tendency for it to rise earlier. These two effects just about balance each other for several days until about January 9th, when the northerly motion of the sun begins to have the greater effect on the time of sunrise. From this date on then the sun begins to rise earlier daily.

It is due to these same causes that the difference between civil time and sun-dial time is variable throughout the year.

R. T. CRAWFORD,
Director Students Observatory, University of California.

Sir: Your statement that the sun did not begin to rise earlier in the ten days following December 21 is correct. In fact, you could have made it stronger in the same direction and still be well within the truth. The explanation lies in what astronomers call the equation of time. The earth's speed in its annual travels around the sun is variable because it is following an elliptic orbit and not a circular orbit. This speed is much higher on January 1, when the earth is in perihelion, than it is about July 1, when the earth is at aphelion. The speed decreases continuously from January 1 to July 1, and increases continuously from July 1 to January 1. The fact that the plane of the earth's orbit—that is the ecliptic—does not coincide with the plane of the earth's equator, but is inclined at about 23½ degrees, is likewise a factor in the problem. Both of these factors affect the times, by our clocks and watches, at which the center of our sun crosses our meridian at noon.

A true solar day at any point on the earth is the interval between two successive transits of the center of the sun over the meridian of that point. The true solar days are of different lengths. It is therefore far from practicable to use the sun as the direct regulator of our clocks and watches. It is not practicable to construct a clock which would take these irregularities into account, and such a clock, even if it could be constructed, would not be a desirable one for the use of the people, for the hours, minutes and seconds on such a clock would be of different lengths in different months, weeks and days.

Recourse is had to a fictitious or mean sun which comes to meridian passage at equal intervals, called the mean solar day. The mean solar day is in length the average of all the true solar days in the year. The true sun is a little west of the mean sun in certain parts of the year and a little east of the mean sun in other parts of the year. On December 21 the true sun was a little west of, and rose two minutes of time before, the mean sun. On January 1 the true sun was east of, and rose 3.6 minutes after, the mean sun. On January 11 the true sun rose 8.0 minutes after the mean sun. We can therefore see that the rising of the sun in the twenty-one days following December 21 was more and more belated because the true sun was getting farther and farther to the east of the fictitious or mean sun which governs our clocks and watches.

The following table gives the Pacific Standard times of sunrise and sunset, and likewise the length of the interval between sunrise and sunset, at Mount Hamilton for the four dates concerned.

	Sunrise	Sunset.	Length of Day.
1916—December 21...	7 hr. 20 min.	4 hr. 51 min.	9 hr. 31 min.
1917—January 1...	7 hr. 23 min.	4 hr. 58 min.	9 hr. 35 min.
January 11...	7 hr. 23 min.	5 hr. 07 min.	9 hr. 44 min.
January 21...	7 hr. 19 min.	5 hr. 17 min.	9 hr. 58 min.

The sun rose a fraction of a minute later by our watches on January 6 than it did on January 1 and January 11.

The position of the real sun with reference to the fictitious (mean) sun which governs our clocks and watches is indicated in the following table for the beginning and middle of each month:

Jan.	1.....	Real sun is	3.6	minutes	east	of	fictitious	sun
	16.....	" " "	9.8	"	"	"	"	"
Feb.	1.....	" " "	13.7	"	"	"	"	"
	15.....	" " "	14.3	"	"	"	"	"
Mar.	1.....	" " "	12.5	"	"	"	"	"
	16.....	" " "	8.8	"	"	"	"	"
Apr.	1.....	" " "	4.0	"	"	"	"	"
	16.....	" " "	0.1	"	west	"	"	"
May	1.....	" " "	3.0	"	"	"	"	"
	16.....	" " "	3.8	"	"	"	"	"
June	1.....	" " "	2.5	"	"	"	"	"
	16.....	" " "	0.3	"	east	"	"	"
July	1.....	" " "	3.5	"	"	"	"	"
	16.....	" " "	5.8	"	"	"	"	"
Aug.	1.....	" " "	6.2	"	"	"	"	"
	16.....	" " "	4.3	"	"	"	"	"
Sept.	1.....	" " "	0.1	"	west	"	"	"
	16.....	" " "	5.0	"	"	"	"	"
Oct.	1.....	" " "	10.2	"	"	"	"	"
	16.....	" " "	14.3	"	"	"	"	"
Nov.	1.....	" " "	16.3	"	"	"	"	"
	16.....	" " "	15.2	"	"	"	"	"
Dec.	1.....	" " "	11.0	"	"	"	"	"
	16.....	" " "	4.4	"	"	"	"	"
	31.....	" " "	3.0	"	east	"	"	"

The slight easterly motion of the true sun with reference to the mean sun, which had the effect of delaying the times of sunrise on the sixteen mornings following December 21, had also the corresponding effect of delaying the times of setting of the true sun with reference to our clocks and watches; that is, as the true sun was east of the mean sun and moving easterly from the true sun, both the risings and the settings of the true sun were delayed in terms of our clock and watch readings.

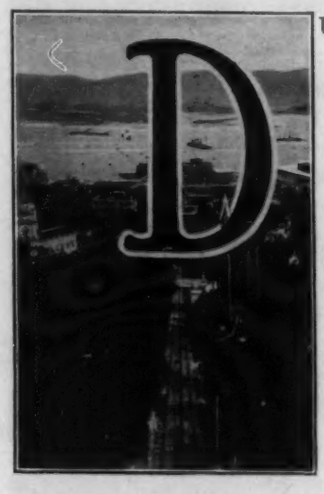
You may be interested to know that about February 11 each year the true sun is 14.6 minutes east of the mean sun; and about November 3 the true sun is about 16.4 minutes west of the mean sun.

W. W. CAMPBELL,
Director Lick Observatory.

SHORT JOURNEYS IN PACIFIC LANDS

(Steel cross-ties with concrete-setting have long been used in countries abroad though their application in this country has been scant. Hong Kong, the second largest shipping port in the world, has of necessity forced the engineer to perform an unusual accomplishment in making habitable a precipitous mountain immediately in the rear of the business section. How this has been accomplished is described in the following article, which is contributed by an American engineer who recently made a visit to all the principal sea-ports of the Orient.—The Editor.)

THE FAMOUS TRAM OF HONG KONG



The Hong Kong Tram With Mammoth Harbor In Distance

DURING the past several months as we have daily followed the accounts of the bloody battles that have been raging in Europe, I doubt if one of us has experienced the passing of a single day without hearing someone quote Sherman's definition of War. If, however, as set forth in this famous saying, war is the only thing that is comparable to give an illuminating concept to the imagination as to the true meaning of the lower region, then we must fail in words sufficient to depict one's feelings on a hot, languid, humid June day in Hong Kong.

Perhaps the English years ago did not express in words their feelings on such days when Hong Kong was young in international importance. At any rate they must have lifted up their heads to the hills from whence came their light for today the residential section of Hong Kong presents at once the most unique and spectacular triumph in engineering ever accomplished in the history of city building.

Immediately back of Hong Kong's superb water front, with the exception of a thin strip reserved for her commercial houses and hotels, the ground rises most precipitously to a height of over 2000 ft. At these higher altitudes the refreshing monsoons, unfelt in the humid business region below make life most desirable and indeed the exquisite scenery and outlook enjoyed from these heights alone, occasioned a longing for the construction of homes along the steep and precipitous sides of the barren mountain.

Hence followed the planting of the mountain side with exquisite shrubbery and the construction of the famous Peak Tramway surrounded on all sides by palatial substantial residences.

The mountain, christened Victoria Hill, is too steep for wagon traffic and the question of a winding railway was entirely beyond consideration as the time for climbing and the cost of construction were too great.

It was decided in 1885 to construct the "Tram," as it is familiarly called in Hong Kong. The road bed is of concrete bedding and is a striking and successful illustration of the use of steel cross-ties which are embedded in the concrete. The cars, two in number, are operated by a steel cable one mile in length. As one car lowers, the other is raised.

Signal wires are stretched along the side of the road bed in order that signals may be sent to the operating house at the top of the hill where the control is maintained and the power driving mechanism installed.

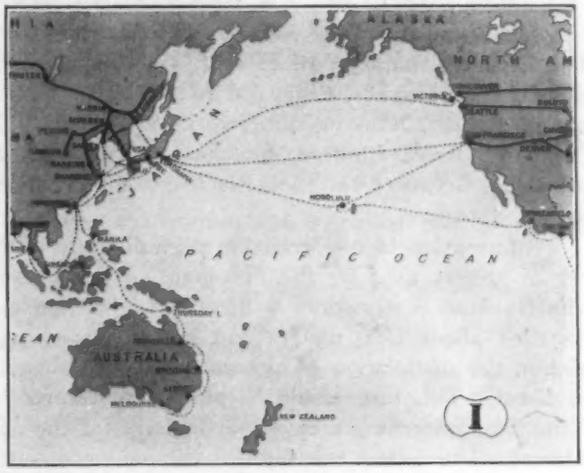
A third rail is installed along the entire route for the purpose of emergency control by means of quickly acting brakes in case of accident. So carefully and successfully has the installation been operated during its thirty years of life that not a single fatal accident has occurred, although thousands upon thousands have been transported up the steep slope.

The fare charge is 50c per round trip in Hong Kong money. This varies in value in the American standard from 23 to 25c.

At intervals of 300 to 400 ft. elevation in the upward journey, stations have been cut at intersecting roads. These level laterals are wonders for permanency in construction. Although used solely for the bare-footed sedan chairmen to bear their burdens to and fro to the Tram, (for the British subject at Hong Kong never walks) the pathways are laid with massive blocks.

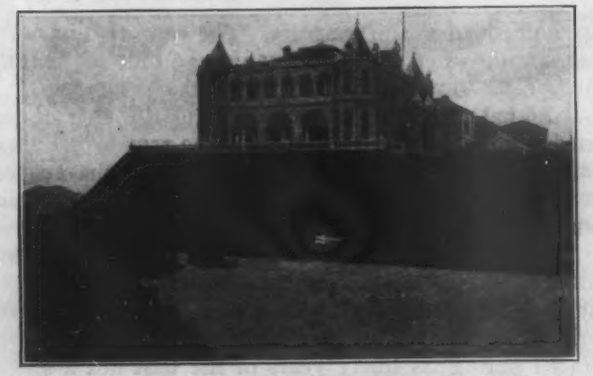
Along these pathways the most beautiful shrubbery has been made to grow and withal Victoria Hill truly presents the appearance of what Paradise is supposed to be.

The buildings which line the pathways leading from the Tram are of massive stone and brick construction built in the most substantial manner. This massiveness of construction is not without its necessities for the violent typhoons which visit Hong Kong



Hong Kong and Other Oriental Ports

from time to time have truly demonstrated that only the most substantial structures can be safely depended upon to withstand at all times their violence. Practically all the materials used in their construction have tediously been drawn up the hill by Chinese women who today may be seen treading their way up the steep pathways bearing burdens of sand and mortar for the buildings now under construction.



The Governor's Residence on Top of the Peak

To cap the climax of architectural and engineering triumph two most palatial structures have been built upon the summit of Victoria Hill. The one is the summer residence of the governor of Hong Kong and the other the Peak Hotel. At the latter place many local families occupy suites of rooms throughout the year and luxuriously enjoy the beauty of scenery and air to be found upon the summit, while the men folk journey back and forth daily to their work in the business district precipitously below.

American engineers, especially those of the electrical engineering professions, interested in development of suburban traffic, will do well to ponder over the possibilities of similar precipitous hills outlying their residential districts, for gigantic outlays of power with its profitable return is in many cases a possibility although without knowledge of this daring but successful precedent, one might well shrink from attempting its development.

METERS FOR ELECTRIC PLANTS IN CHINA

Hankow has four electric-lighting companies. Their names, character of current, and supposed nationality are: Hankow Light & Power Company, alternating, British; Hankow Waterworks & Electric Light Company, direct, Chinese; Melchers & Company, alternating, German; Tai Shoh Electric Company, alternating, Japanese.

Information is not available regarding the number of meters used by the first-mentioned company. The Hankow Waterworks & Electric Light Company installed about 1700 meters and has under contemplation the installation of alternating current instead of direct. This firm would be pleased to receive information concerning meters, particularly for the new current. The meters used by this company are American and Ferranti.

OZONE FOR THE CHILDREN—IV. OR ENGINEERING TWISTERS RETOLD

After the recital of the last twister the old sea captain was so pleased that he invited me to a duck dinner. It was needless to say that all was most enjoyable, for there is no hospitality quite equal to that engendered by one who follows a life upon the sea.

I was somewhat disappointed, however, when only one duck appeared upon the platter so I decided to make the best of it.

"Captain," says I, "there are two ducks on that platter instead of one."

"No," said he, "there is but one duck."

"Well," says I, "I'll prove it."

I then proceeded as follows:

Let $x =$ number of ducks on platter or $x = d$, multiply both sides of the equation by d, we have

$$dx = d^2$$

Now subtract x^2 from both sides of the equation, which is perfectly allowable in mathematical science. Thus

$$dx - x^2 = d^2 - x^2$$

Now factoring, I have

$$x(d - x) = (d - x)(d + x)$$

Correcting out the common factor $(d - x)$, we have

$$x = d + x$$

But $x = d$, or substituting

$$d = d + d$$

$$\text{or } d = 2d$$

$$\therefore 1 = 2,$$

which is to say there must be two ducks on the platter.

The old sea captain was breathless in astonishment. Silently however, he looked at me, then at the duck, and jabbing his fork into its body, he slid the fowl on to his private plate and quietly said:

"Now, professor, you can have the other duck."

COMMERCIAL AND ENGINEERING TRAVELERS IN LATIN AMERICA

There has been a large demand for the monograph recently published by the Bureau of Foreign and Domestic Commerce which gives in detail the regulations with which commercial travelers visiting the Latin American countries must comply and contains general information of value to those undertaking to introduce American goods into these countries. The material in this publication was furnished by American consular officers in each of the Republics of Central and South America and covers such important subjects as license fees and the way of legitimately avoiding them in certain countries, documents with which travelers should be furnished, custom house requirements affecting travelers' samples and advertising matter, buying seasons, hotel and other expenses, etc. The price of this publication, which is known as Commercial Travelers in Latin America (Tariff Series, No. 35), is 10 cents, and copies may be purchased from the Superintendent of Documents, Washington, D. C., or from any of the district officers of the Bureau of Foreign and Domestic Commerce.

PHOTOGRAPHY FOR THE ENGINEER

BY C. B. MERRICK

(Photography continues to play an important role in the life of the engineer. Few, however, have the time to give to it that is necessary for mastering essential details. In a series of four articles, the author, who is with the Pacific Gas & Electric Company, and who has made photography a pastime, will set forth tabulated snappy points that should be placed in the notebook of the engineer for quick reference in case of camera utilization.—The Editor.)

San Francisco Bay From Tower of Jewels

THE applications of photography to engineering are so many and varied that it is often necessary to take pictures under extremely adverse conditions. The most satisfactory and certain way of obtaining good results at such times is to use an exposure meter, but due to the wide range of exposure which will satisfactorily expose a plate or film, it is possible to make good pictures by estimating the amount of light falling upon the object to be photographed.

Most failures are caused by not making sufficient allowance for varying intensities of light. The great allowance necessary is illustrated by the accompanying photographs, which with one exception, were all taken on bright summer days. Fig. 1 has the shortest exposure of the set. Fig. 2 had twice the equivalent exposure of No. 1. Fig. 3 had four times and the night scene in Fig. 4 had thirty thousand times that of No. 1.

The exposure necessary is influenced by the characteristics of the object to be photographed, by the intensity of the direct light upon it, and the reflected light from its surroundings, as well as by the distance from the camera.

Thirty Thousand Times the Light for Night Scene as Compared With Day Scene

As an example Fig. 1 was taken at 2 p. m. on a bright day in March. The subject was a distant bay scene with the sun shining directly upon it, the reflected light was strong, due to the broad open view, thus requiring a short exposure. Fig. 2 was taken directly against the sun. This was possible by shading

The Golden Gate Against the Sun

the lens from the sun's direct rays and giving a longer exposure since most of the view was in the shade. Fig. 3 was brilliantly illuminated by the direct light of the sun, but the reflected light was very considerably reduced. The exposure was necessarily lengthened.

So many factors are to be considered in estimating exposures that each one should be judged separately, and then the result of the combination will be as close as it can be estimated.

Because he makes too little allowance for variations in intensity of illumination, the beginner usually over-exposes distant landscapes, sea and sky views, while shaded and indoor views are under-exposed. Since more views are taken near at hand, and since under-exposure is a more serious fault than over-exposure, more failures result from under-exposure. Fundamental rules to be remembered are:

1. Give ample exposure.
2. Expose for shadows and let the high lights take care of themselves.
3. Exposure varies inversely with the distance from the camera.
4. Consider photo colors as well as eye colors.
5. Winter views require twice the exposure of summer views.
6. Use slowest shutter speed which will stop motion of objects in view.
7. Use a tripod for exposures longer than 1-25 second.
8. Shield the lens from direct sunshine.

The factors which control each exposure are classified as follows:

1. Characteristics of the object.
3. Type of day (weather).
2. Time of day (including direction of light).
4. Time of year.
5. Distance from camera.

THE PUTTING IN OF THE WISE POWER PLANT

(New records in physical proportion and in efficiency of design are constantly being established in hydroelectric practice in the West. Here is an account of the putting into service of a remarkable new power plant of the Pacific Gas & Electric Company, which owns the largest high tension distribution system in the world. The Wise plant, commemorating the youth of the West in its dedication to the memory of one of her most distinguished young engineers, presents to the hydroelectric fraternity a new record in size of turbine unit.—The Editor.)

The Late James Hugh Wise

AS Mrs. Clara Wise, mother of the brilliant young engineer, the late James Hugh Wise, threw in the switch that started the pumping of energy into the world's greatest long distance transmission net work some one remarked: "How fitting it is that a beautiful creation such as this new plant, which contains the largest single discharge turbine unit ever built in the history of engineering, should be named in memory of this young man."

And indeed the ceaseless generation of energy that will continue throughout endless time without diminution in its eternal source is symbolic of the energy of youth commemorated in the naming of this new creation of the Pacific Gas & Electric Company's system of hydroelectric development.

The new single discharge turbine is of 20,000 h.p. capacity and generates an additional 16,750 h.p. of electrical energy, making a grand total of nearly a quarter of a million horsepower of installed capacity in steam and electric generation for this system, which now supplies two-thirds the people of California with electrical energy and comprises the largest high tension distribution network thus far created in the art of electrical distribution.

THE CEREMONY AT THE SWITCHBOARD

W. C. J. Finely, J. P. Jollyman, John A. Britton, Mrs. Clara Wise, Jim Martin, P. M. Downing, and F. G. Baum.

The ceremony was simple, yet most impressive. Mrs. Wise, ably assisted by John A. Britton, the veteran head of the Pacific Gas & Electric Company, together with F. G. Baum, chief construction engineer, and P. M. Downing, chief engineer in the hydroelectric department, threw the switch shortly after one o'clock, on Sunday afternoon, March 4, 1917, and the Wise Plant beautifully responded to its summons without a shock or complaint and from now on will be an indissoluble unit in this remarkable system of hydroelectric generation in California.

A description of the physical features of this remarkable installation appeared in the columns of the Journal in the issues of September 30, 1916, and October 21, 1916. For the sake of completeness a resume of the unusual characteristics of this power plant will now be made.

The water from the new Halsey plant some seven and one-half miles above, after passing through a regulating pond, is conveyed through canals, tunnels and storage dams, finally to be dropped through the penstock pipe a vertical distance of 519 ft. into the Wise Power Plant.

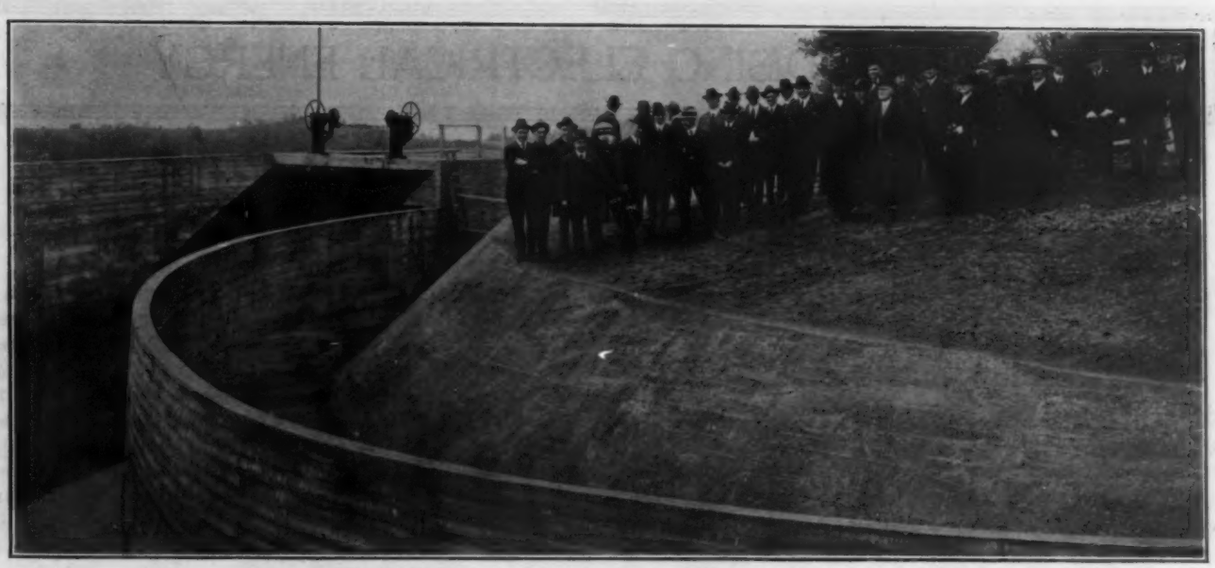
Practically every type of conduit is used in one place or another in the construction of the canal. For instance, at one point open ditch is followed by semicircular steel fluming which later serves a masonry lined run of canal. At another point, the water passes from a forebay into wood stave piping, then through two pressure tunnels—concrete lined—again emerging into wood stave piping which finally serves the heavy steel riveted penstock piping that delivers the water to the giant Francis type of turbine in the power house below.

The generator unit is of 12,500 kw. capacity of the Westinghouse design. The turbine is of the Pelton-Doble design and is the one exhibited by the Pelton Water Wheel Company at the Panama-Pacific International Exposition in San Francisco.

The engineering considerations that led to the adoption of this giant turbine are interesting. The generator speed being fixed at 360 r.p.m. and the available head at 510 ft., a single nozzle, tangential wheel, having a specific speed of 5, would develop 100 h.p. To develop 20,000 h.p. the predetermined size of unit would require 20 jets, a combination impracticable under operating conditions. On the other hand, a turbine with a specific speed of 20 would develop 18,000 h.p. and 360 r.p.m. under a head of 500 ft. These limitations indicated a reaction turbine as the most suitable type of water wheel.

The Wise Power Plant is one of six that ultimately will constitute what is known as the Lake Spaulding development. Three of these plants are now in operation. The time for constructing the others has not been set.

A tunnel has been driven through the almost per-

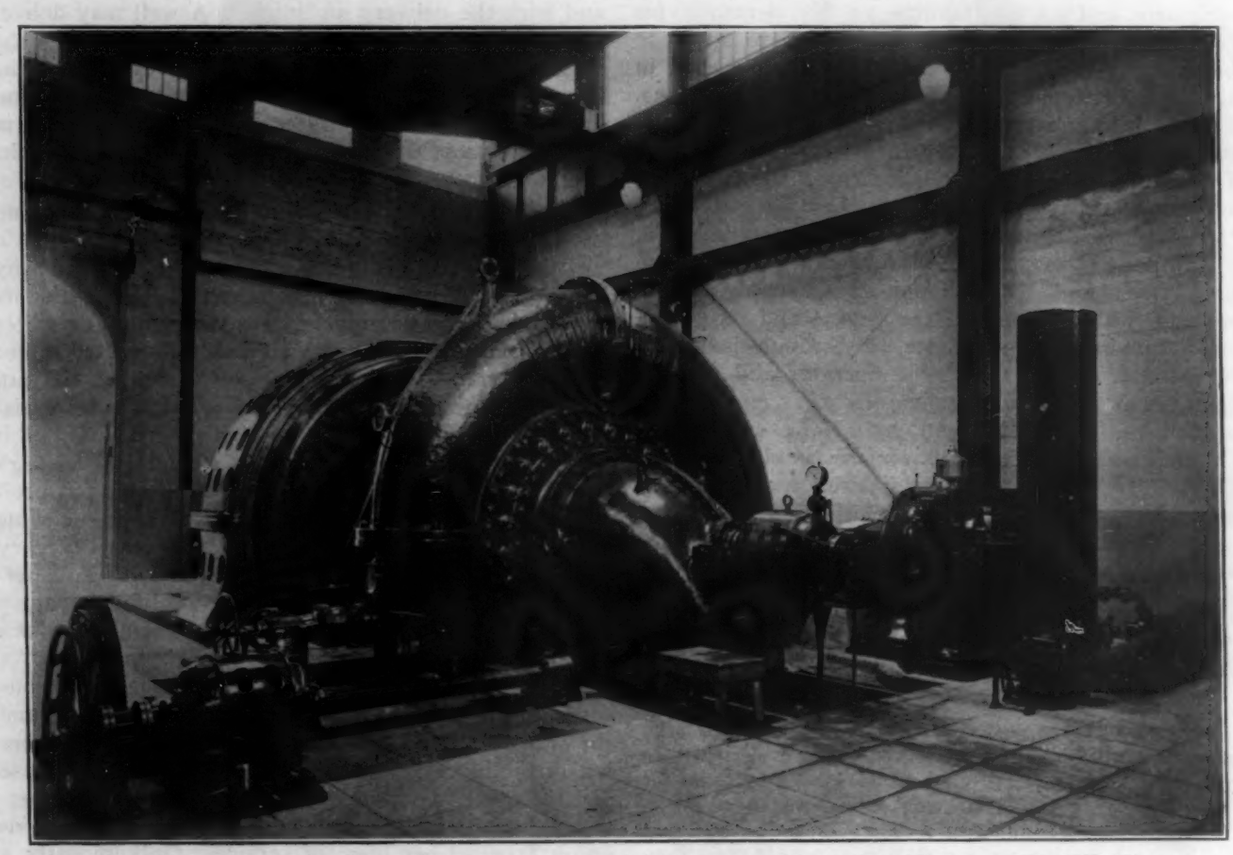


Officials and Prominent Engineers at the Intake of the Penstock of the Wise Power Plant

pendicular granite wall at the Spaulding dam, whereby its reservoired waters are started on their journey. After passing through the Drum and Halsey power houses, these waters finally drive the turbine at the Wise plant. The total potential power development of the entire system is 6000 kw. at the Spaulding, 50,000 kw. at the Drum, 25,000 kw. at No. 2, 15,000 kw. at the Halsey, 12,500 kw. at the Wise, and 15,000 kw. at No. 5, making a grand total of 123,500 kw.

The exterior of the power house represents the last word in artistic design. It is arranged so that it can be flood-lighted at night and will serve as a remarkable monument of publicity for the company in that the Lincoln Highway and the transcontinental lines of the Southern Pacific Company pass within easy vision of the location of the power house.

As a whole the completion of this project represents not only a triumph in engineering for those having the work in hand, but a distinct advance in the art of hydroelectric generation.



Interior View, showing Generator and Turbine, the latter being the Largest Single Discharge Unit in Existence

MERCHANDISING ELECTRICAL ENERGY

(To successfully merchandise electrical energy, the commercial engineer must so plan his campaign that he not only sees to it that his client purchases the necessary current consuming apparatus but above all he must see to it that the sale is a proper one from the standpoint of economy to the purchaser. Here is a valuable contribution on how to check up on the machinery salesman that should immensely forward permanency and satisfaction among clients of the power company. The author is commercial engineer for the Southern Sierra Power Company of Riverside, Cal.—The Editor.)

CHECKING UP ON THE MACHINERY SALESMAN

BY ROSS B. MATEER

Due, not only to the climate, but to the extensive advertising campaign of California lands, prosperous farmers of the Middle West States are acquiring ownership to extensive acreage of unimproved lands with the avowed purpose of growing profitable crops. At first grain is experimented with in an attempt to dry farm, then wells are sunk and the ground turned over for the seeding of alfalfa. A fair stand is obtained before the close of the first year and as the price per ton of alfalfa increases, visions of unincumbered lands and a fair bank account seem fair to be realized until a scarcity of water is experienced for the adequate irrigation of the acreage under cultivation or the crude method of delivering the water to the soil and arising from improper preparation of the land results in an apparently high cost per inch of water pumped. Confronted with an apparent deficit, the rancher is apt to ascribe his failure to the power used to operate his plant rather than to the character of the pumping equipment and its adaptability to his demands for water or to his oversight in attempting to apply to the growing of California crops methods pursued in states subject to different climatic and soil conditions. It is at this time the rancher is most in need of assitance and to whom can he turn with the assurance of receiving trustworthy information other than to the field agent of a quasi public utility, bent on upbuilding a territory with aggressive intelligent agriculturists.

The power used may be the "barking dog" whose sustenance is fuel oil and though a good supply may be on hand, yet ignorance of the engine and its operation results in a heavy expense, (1) through the forced employment of an experienced operator and (2) the replacement of parts damaged by changes in fuel, engine installation, alignment, etc. Not every rancher is a mechanic and as expensive farm implements are permitted to remain, when not in use, out in the open and subject to all conditions of weather and in various stages of repair, so may internal combustion engines be a source of dissatisfaction to the average rancher as is illustrated by recent correspondence with a supply branch:

"Apple Valley, Aug. 11, 1916.

"Gents:—The gas engine you sent me stops when theres nothing the matter with it thats the trouble. it wouldn't bee so bad if it stopped for some reason and anybody knows theres reasons enough for it to stop. and why cant it pick out one of them reasons for stopping instead of stopping for no reason at all so that no one cant find the reason because you cant find a reason can you when there aint no reason thats common sense aint it.

"I received the book which you sent me which is named What Makes the Gasoline Engine Go. I aint read it yet because whats the use of reading it when I dont care what makes the gasoline engine go as long as it goes which mine dont only occasionally when not particularly needed but just when experimenting or something. what I want to know is What Makes the Gasoline Engine Stop. if you got a book called that send me one and thats what I want to know particularly what makes my gasoline engine stop when everything is o k and nothing is the matter except that it must be a rotten engine."

Again the equipment installed may be too large for the quantity of water developed in the well and the pump remains as a monument to the salesmanship of the machinery house's representative whose remuneration was a percentage of the sum invested in the engine and pump and whose interest in the customer and his welfare ceased upon the delivery of, the installation of and the payment for the pumping unit, contrary if you please to the progressive policy of the modern central station and whose interest in a consumer only begins after the installation of the plant and with the delivery of "juice." A well may deliver seventy-five inches of water without exceeding the suction limit, yet salesmen advocate or permit the farmer to install a pump with a capacity for one hundred twenty inches of water or more which error in the selection of equipment is glaringly evident in the operating cost.

Again why not use judgment in the choice of a pump with reference to the duty demanded of it. When a well is sunk and a pit has been dug and curbed why boost for a vertical belt-driven outfit with its frame, shaft and bearings, except where varying water levels are found, when a small direct connected motor operated centrifugal unit may be placed in the pit, just above the normal water level with a smaller initial investment and a lower operating expense. Or, if it is not desired to dig a pit why encourage the high speed turbine pump when the deep well plunger, positive acting unit may be installed for perhaps the same investment though with an increase in plant efficiency of from ten to twenty per cent—and with an operating economy equal to perhaps the total fixed charges on the investment,—interest, depreciation, insurance etc.

Problems as above cited confront the conscientious representative of a public utility almost daily and the only solution is education, not alone of the rancher but of the machinery salesman. The one to purchase and the other to sell only such apparatus as will operate without attendance or many repairs and at a minimum expense per hour of service. Only recently a representative of a reliable manufacturing company

when requested to quote on a turbine pump for service in connection with a fourteen inch well and with a lift of one hundred twenty-five feet, frankly referred the inquiry to a firm building and installing deep well plunger heads, earning the good will of both customer and central station.

Exemplary of the assertion as to the over-rating of the original installation were the engines and pumps recently displaced with electrically driven units in the vicinity of Winchester, California. Here as a result of a thorough investigation of the water conditions, the capacity of the engine driven units and the demand for water one hundred and thirteen horsepower in gas-oil operated engines were displaced with seventy-five horsepower in General Electric polyphase motors and Byron-Jackson pumps of suitable capacity for the wells. Consideration of the acreage to be irrigated and the crops grown further convinced the consumer that for several years, only three of the new electrically driven plants would be required for the thorough watering of his soil, permitting the fourth plant to remain as a reserve unit. A recapitulation of a portion of the report may be of interest.

	Plant No	H.P. of Engine	Gals. of Fuel Used per Hour	B.H.P. at Pulley on basis of lift per h.p. per hr	Size of Cent. Pump now Installed	Normal Capacity of Pump	Estimated Amount now Pumping on Average
Plant No.	1	18	1¼	10	No. 5	45 in.	30 in. to 40 in.
Plant No.	2	25	2	16	No. 6	70 in.	40 in. to 50 in.
Plant No.	3	25	2½	20	No. 8	175 in.	50 in. to 60 in.
Plant No	4	35	3½	28	No. 8	175 in.	90in. to 100 in.

Plant No.	Dist. of Water from Surface	Dist of. Pump from Surface	Vacuum in Feet when Pumping	Lift Above Surface	Total Feet
Plant No. 1	4	10 ft.	27	4	41 ft.
Plant No. 2	4	10 ft.	27	4	41 ft.
Plant No. 3	6	10 ft.	27	4	41 ft
Plant No. 4	4	10 ft.	27	4	41 ft.

PlantNo	Estimated H.P. Required to Operate Present Pump	H.P. of Motor Recommended	Size of Pump.	Capacity.	E.H.P.	K.W.	Horsepower Input by Test
Plant No 1	10	10	No. 4	40 in.	9.3	6.9	6.15
Plant No. 2	16	15	No. 4	50 in.	13.7	10.2	9.87
Plant No. 3	20	15	No. 5	60 in.	14.9	11.1	12.85
Plant No. 4	28	25	No. 6	100 in.	22.4	16.7	

Plants one, two and three with a combined horsepower input at the meter of twenty-eight and eighty-seven (28.87) in continuous operation for two thousand three hundred forty-eight (2348) hours and an expense of four hundred nine dollars ($409.00) were supplied with service at a fixed or flat charge per horsepower of maximum demand per season.

To provide for increased head when irrigating and for the conservation of water a large earthen basin seventy-five (75) by ten (10) ft, has recently been completed. This basin will store all the water pumped throughout the night eliminating the rather unsatisfactory flooding of the ground by "lamp light.'

RESUSCITATION FROM ELECTRIC SHOCK

FIG. 1—INSPIRATION: PRESSURE OFF.

FIG. 2—EXPIRATION: PRESSURE ON.

FOLLOW THESE INSTRUCTIONS EVEN IF VICTIM APPEARS DEAD

I. IMMEDIATELY BREAK THE CIRCUIT

With a single quick motion free the victim from the current. Use any **dry non-conductor** (clothing, rope, board), to move either the victim or the wire. Beware of using metal or any moist material. While freeing the victim from the live conductor have every effort also made to shut off the current quickly.

II. INSTANTLY ATTEND TO THE VICTIM'S BREATHING

1. As soon as the victim is clear of the conductor, rapidly feel with your finger in his mouth and throat and remove any foreign body (tobacco, false teeth, etc.). Then **begin artificial respiration at once.** Do not stop to loosen the victim's clothing now; **every moment of delay is serious.** Proceed as follows:

(a) Lay the subject on his belly, with arms extended as straight forward as possible, and with face to one side, so that nose and mouth are free for breathing (see Fig. 1). Let an assistant draw forward the subject's tongue.

(b) Kneel straddling the subject's thighs and facing his head; rest the palms of your hands on the loins (on the muscles of the small of the back), with fingers spread over the lowest ribs, as in Fig. 1.

(c) With arms held straight, swing forward slowly so that the weight of your body is gradually, but **not violently,** brought to bear upon the subject (see Fig. 2). This act should take from two to three seconds.

(d) Then immediately swing backward so as to remove the pressure, thus returning to the position shown in Fig. 1.

(e) Repeat deliberately twelve to fifteen times a minute the swinging forward and back—a complete respiration in four or five seconds.

(f) As soon as this artificial respiration has been started, and while it is being continued, an assistant should loosen any tight clothing about the subject's neck, chest, or waist.

2. Continue the artificial respiration (if necessary, two hours or longer), **without interruption,** until natural breathing is restored. If natural breathing stops after being restored, use artificial respiration again.

3. Do not give any liquid by mouth until the subject is fully conscious.

4. Give the subject fresh air, but keep him warm.

The prone-pressure method of artificial respiration described in the rules (Section II), is equally applicable, after clearing the mouth and throat of froth, to the resuscitation of the apparently drowned, and also to cases of suspended respiration due to inhalation of gas or other causes. —*Reproduced by permission of the National Electric Light Association.*

SUGGESTIONS FOR CONTRACTOR AND DEALER

DEPARTMENT CONDUCTED BY GEORGE A. SCHNEIDER

(Few realize the immense field of profit open to the contractor and dealer in the way of electrical farm specialties and appliances. Here is a valuable discussion on farm lighting plants followed by "up-to-the-minute" briefs on a remedy for damaged pressure switches, power required to drive generators, and the size of wire for flood-lighting projectors. The author, who is a power apparatus specialist, is with a prominent electrical supply house in San Francisco.—The Editor.)

FARM LIGHTING PLANTS—THE GOLDEN OPPORTUNITY FOR THE ELECTRICAL CONTRACTOR

It was our distinct pleasure recently to be in the advertising department of one of the country's largest electrical manufacturers. While there, we saw in one day's mail hundreds of letters asking for a certain electrical hand book that is being distributed to farmers on request. Each one of these requests represents a potential buyer of a small lighting plant for farm use. Each potential buyer of a small lighting plant represents a most fertile field for the electrical contractor.

Typical Farm Lighting Plant, showing Generator and Switchboard Mounted On Skids

For years the electrical contractor has had his business limited by certain defined lines. Wherever electrical service was rendered by a central station there was opportunity for the electrical contractor—houses could be wired and appliances sold. But the territory beyond that covered by the central station was arid as far as electrical work was concerned. Where there is no electricity there is no sale for electrical appliances—no electrical contracts to be bid for.

But now the advent of the perfected electric lighting plant for the farmer opens up a vast new field for the contractor. As a matter of fact, it breaks down all trade barriers and makes the country an open market for the electrical contractor. The contractor who has the agency for farm lighting plants can, first of all, sell the plant; he can then install it, which, of course, means the wiring of the house, barn and outbuildings; second, he can sell sockets, fixtures and switches; third, he can equip the farm with socket appliances, such as vacuum cleaners, washing machines, irons, etc. Each distinct step entails a profit and represents a business that is worth the efforts of the most progressive merchandising man.

Never in the history of the country has the farmer element been as prosperous as it is today. One of the greatest fields for the automobile industry is the farmer, and one of the greatest fields for the electrical contractor will be the farmer. If any electrical contractor will make a survey of the number of farmers surrounding him, and if he will consider each one a potential buyer of a lighting plant, and if he will further consider each one as a buyer of socket appliances, he will realize that a gold mine lies at his feet.

The large manufacturers responsible for the development of the farm lighting plant are spending enormous sums for advertising these small electric lighting plants—their advertising reaching every farmer in the country. An elaborate electrical hand book has been made up and written especially for the farmer, and is being distributed to the four corners of the country by the thousands. Publicity of this sort cannot help but show returns, and the number of farm lighting plants that are being sold daily attest to the value and effectiveness of this publicity.

It is the wise contractor who gets in early on this farm lighting plant proposition and secures the exclusive agency in his territory for its sale. It is a virgin field, representing a bonanza for the contractor who is looking for business and plenty of it.

A REMEDY FOR DAMAGED PRESSURE SWITCHES

There are a number of diaphragm pressure or regulator switches on the market. While these are designed primarily for use as pilot switches with self starters, a number of them have contacts large enough to handle the current of small motors which can be started by being thrown directly across the line. The limit of capacity of such switches is about 3 h.p. at 110 volts or 5 h.p. at 220 volts, for either single or polyphase circuits.

Quite often, however, these switches are selected to control motors somewhat larger than their rated capacity, the idea being to effect a saving in the first cost of the controlling apparatus. For example, it is not uncommon to find switches rated 3 h.p. at 110 volts in use with 5 h.p. motors of the same voltage. When overloaded in this manner the contacts are very likely to give trouble in a short time, especially if the service is severe, requiring a large number of operations per day. Under these conditions, if the contacts become burned or damaged it rarely pays to repair or replace them because the trouble will invariably occur again unless the load on the switch is reduced. In other

words, such repairs would really be only temporary, at least this has been the writer's experience.

The proper way to remedy such troubles is, of course, to provide some form of self-starter, allowing the pressure switch to handle only the current required by the pilot or control circuit of the starter. If the contacts are not too badly burned, it may not be necessary to replace them when adding the self-starter, because only a small current is required to operate such devices. But the burned parts should be carefully cleaned and readjusted to make the best possible contact. If the switches are double-pole, it is well to connect both sides in parallel, thus making a single-pole switch of double the carrying capacity, since only single-pole switches are required for pilot circuits.

POWER REQUIRED TO DRIVE GENERATORS

A "rule of the thumb" method of determining the power required to drive a direct-current generator at full-load is to allow 1.6 horsepower per kilowatt of generator capacity. Thus, a 10 kilowatt generator at full load would require 16 horsepower at its driving pulley or shaft. This factor is based on an efficiency of 82 per cent at full load and is a fair average value for direct-current belted generators in sizes up to about 75 kilowatts. It is figured in this way. One kilowatt or one thousand watts output at an efficiency of 82 per cent requires an input of

$$\frac{1000}{.82} = 1220 \text{ watts,}$$

which is practically 1.6 horsepower since there are 746 watts per horsepower.

By averaging the efficiencies of the different sizes more carefully and then carrying out the same calculations just shown we can arrive at three factors which will be sufficiently accurate for all practical purposes and at the same time take into consideration the increase in efficiency which occurs in the larger sizes. These are given in the following tabulation:

Rating of Generator	Average Full Load Efficiency	Watts Input per Kw. Output	H.P. Input per Kw. Output	Factor
Less than 2 kw.	75%	1333	1.79	1.8
3 to 20 kw.....	82%	1220	1.64	1.6
20 to 75 kw.....	86%	1163	1.51	1.5

These factors do not take into consideration the overload capacity of the generator although most types of machines, as now rated, will carry 25 per cent overload for two hours without excessive heating. If it is desired to take advantage of this overload capacity the horsepower required to drive at full load, as estimated by using any of the above factors, should be increased by 25 per cent. Thus, a 15 kilowatt generator operated at this overload will require $15 \times 1.6 \times 1.25 = 30$ h.p.

When generators are driven by motors it is not necessary to allow for this overload capacity, as motors are rated to carry the same percentage of overload as generators. Therefore, a motor large enough to operate a machine at its full load will also be large enough to drive it at any overload it may safely carry. However, when gasoline or steam engines are to be used their overload capacities should always be ascertained as most of them are closely rated and will not stand as much overload as the ordinary generator. Again it must be remembered that the rating of a gasoline engine is affected by the altitude at which it is operated, the output decreasing as the altitude increases.

These calculations are extremely simple and elementary but are explained in detail because such questions are brought up so frequently in connection with small generator installations.

SIZE OF WIRE FOR FLOOD-LIGHTING PROJECTORS

Satisfactory results from flood-lighting projectors should not be expected unless the lamps in them are burned at practically their rated voltage. This is true of any Mazda lamp but the manufacturers of projectors have been particular in emphasizing this point because there is more likelihood of these lamps being used on circuits of excessive voltage drop.

The correctness of this reasoning will be apparent if it is remembered that these projectors are frequently used at a considerable distance from the service mains, for instance as they would be when placed on the top of a building to illuminate a sign or tank or for similar service. Again many of these projectors are used on rush construction jobs where large areas are to be lighted. The wiring is generally only temporary and often any wire at hand is put into service without regard to its size. Then the circuits are frequently lengthened as work progresses and the splices poorly made, all of which are favorable to large voltage drop. The maximum drop in any case should not be over 2 per cent and preferably less.

The proper size wire for these lamps can be easily selected from the accompanying table which gives the length of the circuit one way in feet for a drop of 2 volts which is equal to almost 2 per cent of the delivered voltage assuming 115 volts at the lamp terminals. Note carefully that the length of the circuit means the total distance between the lamp terminals and the service mains and not the total length of wire in the circuit. In a two-wire circuit the total length of wire would of course, be twice the distance in the table.

By remembering that the voltage drop is proportionate to the length and wattage of the circuit this table can be used for leads supplying a number of lamps or for circuits of greater lengths. Also for other lighting circuits or to check the approximate voltage drop in a given circuit.

The three sizes marked with an asterisk are the new ratings which have just been standardized for projector service.

Wiring Table for Two Volts Drop—Lamp Voltage 115

Wattage of Lamp or Load	Size of Wire—B. and S. Gauge No. 14	No. 12	No. 10	No. 8	No. 6	No. 4
200*	232	368	586	934	1484	2360
300	155	246	392	622	990	1572
400*	116	184	294	374	742	1178
500	92	148	234	374	594	944
750	62	98	156	248	396	628
1000*	46	74	116	186	296	472

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING

(The distribution of water in irrigation pumping is a detail little thought of and yet statistics show that herein are brought about the greatest losses in the conveyance of water from the underground source to its place of application. Herein the author sets forth a discussion of the best methods that should be employed in its distribution.—The Editor.)

Pressure Stand for Walnuts | Small Pressure Stand for Oranges | Pressure Stand in Operation

DISTRIBUTION OF WATER TO FURROWS

The furrow method of irrigation is extensively used in irrigation pumping practice. This is due to the fact that crops of relatively high value are required under the higher lifts and these crops are generally orchards or row crops which are adapted to furrow irrigation. The size of irrigation stream secured from many plants is also too small for effective use in flooding but may be suitable for furrow irrigation. With furrow irrigation equal efficiency in the use of the water can be obtained with very small heads by varying the number of furrows run at a time in proportion to the supply. The best labor efficiency in application is of course obtained with supplies sufficiently large to fully occupy an irrigator.

The first essential in furrow irrigation is some means of controlling the flow into each furrow. If efficient use of the water received is to be made it must be divided between the different furrows in proportion to the needs of the soil to be irrigated from each furrow. This need is generally uniform per furrow, and the water is divided equally among all the furrows in use. In some cases, such as on irregular areas or where furrows next to the trees in orchards are zig-zagged more water may be intentionally turned into some furrows than into others.

The stream used per furrow naturally varies rather widely. For potatoes, where the furrows are relatively large, more than 2 miners' inches per furrow or 25 or less furrows per second foot may be used. In furrow irrigation of grain and alfalfa as practiced in some localities on steep and heavy soil a second foot may supply 150 furrows. In usual orchard practice the supply per furrow does not often exceed 1 miners' inch or 50 furrows per second foot and frequently not over one-half this amount or even less will be used. The division of a stream into these small parts requires some fairly complete method of control if satisfactory results are to be obtained.

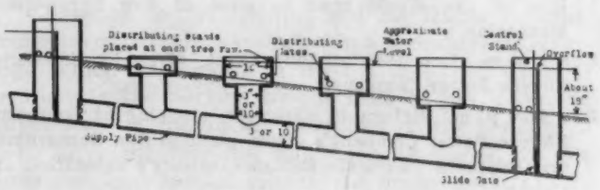
The methods used in distributing water to furrows vary with the crop and the value of the water. Where water is plentiful and the crops temporary, simple shovel cuts in the banks of the field ditches may be made for each irrigation. Where water is expensive and the crop permanent and of high value, the stream used may be distributed through concrete pipe systems in which it is under practically complete control and can be very closely divided.

The crudest methods are those where earth ditches are used. In general irrigated farming where crop rotation is practical each field may be in crops which are irrigated by furrows for only one or two years out of each five to eight years. The other crops grown are generally flooded so that the cheaper and more temporary methods of distribution to furrows are used. The field ditches used for the flooded crops if permanent may also be used for the furrow crops.

Instead of taking each furrow directly from the supply ditch, one cut in the ditch bank may be used to supply 5 to 10 furrows by means of short ditches or sets. This gives a double regulation, the cuts in the banks of the supply ditch being made of sufficient size to supply the set and this flow again divided among each of the group of furrows. The disadvantages of this cutting of the banks are the lack of uniformity in the flow in the furrows resulting in waste from some and probably an insufficient supply in others and the larger amount of labor required during irrigation. The flow in each furrow is regulated by enlarging the cuts when an increase in flow is desired and in closing with earth, hay, manure or grass when the flow is to be reduced. In one experiment carried out on sugar beets in Colorado by the U. S. Department of Agriculture, the yield on one tract irrigated by this method was lower by 15 per cent than that on an adjoining plat to which the flow was controlled by lath boxes in the banks.

The next method used consists of placing lath boxes or other tubes through the banks of the supply ditch. All such tubes above any given ditch check should be placed at the same elevation. This gives uniform flow through the crop with less waste. It is frequently used for areas which are to be irrigated by furrows for 2 years or over. The cost of such boxes is not usually warranted by the saving that could be made in a single year's use.

What are known as irrigation lath, ½ × 2 × 3 ft. are generally used. Four of these lath give an opening of about 2 square inches and when set about 4 in. below the water surface will give a flow of about 1/25 of a second foot. The cost is about 6.5 cents each in place. Second hand pipe up to 3 in. in diameter may be used when obtainable. Galvanized tubes for this purpose are also handled by some of the irrigation supply houses. The flow through the lath tubes is



Typical Overflow System

regulated by small blocks inserted in the tube or nailed to one corner and revolved to give the area desired. This method gives a much more uniform distribution of the water and requires less attention in irrigating than the use of earth cuts.

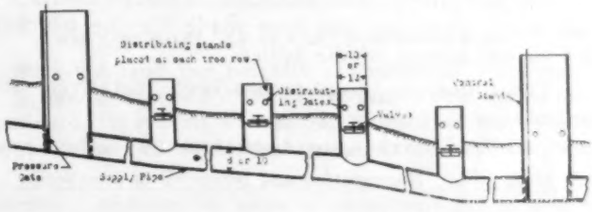
Where fields are to be irrigated by furrows for from 3 to 6 years wood flumes are frequently used. These have a useful life sufficiently long for such purposes. The flumes are usually made of 3 pieces 1x12 or occasionally 1x8, depending on the stream handled. Occasionally a two-board triangular flume is used. Diversion to the furrows is made by boring holes in the side at the bottom. These holes vary from ½ to 2 in., depending on the stream to be run in the furrow. When not in use they may be closed with wood plugs of the same diameter as the hole or small galvanized spout gates may be used, similar to those used with concrete pipe. Such flumes are in general use in garden and truck irrigation. For permanent furrow systems such as those used in the irrigation of orchards, concrete pipe distributing systems are used where the value of water is high. This condition occurs generally in Southern California. The longer season and greater number of irrigations given citrus fruits also makes economical methods more profitable than they would be for localities having shorter crop seasons. Concrete flumes have been used for similar conditions. The use of such flumes preceded the use of pipe and many flume installations are still used in the older localities as around Riverside. It is probable that at present over 90 per cent of the new installations are concrete pipes in preference to concrete flumes. The difference in cost for the sizes of pipe generally used is small and the greater convenience in cultivation and other factors make the pipe preferable. Distribution from concrete flumes is made through openings in the side similar to those used with wood flumes.

Where concrete pipe is used, there are two general methods of distributing water to the furrows. In both methods a concrete stand is used, generally placed at each tree row. In the overflow system these stands are arranged so that the water will rise in each stand of the series to approximately the same height, the control of the flow to the furrows being secured entirely through the small slide gates or spouts. In the other method known as the pressure system each stand contains a valve which controls the flow from the supply pipe into the stand. In both methods check or control stands are used at intervals.

In the overflow system, the control stands are placed at differences of elevation of about 18 in. Where the land slopes more than 18 in. or 2 ft. per 100 ft., this brings such overflow stands too closely together and the pressure system is preferable. The overflow or spillway is located so that the water will be checked back in the delivery stands above to the desired height above the distributing gates. The flow into each furrow is then controlled by the distributing gates or slides.

In the pressure system, control stands need only be placed sufficiently near together that the pressure will not exceed that to which it is desired to subject the pipe or for convenience in operation. The opening of the valve is adjusted to the pressure at each stand so that the water in the stands rises to about the same height above the distributing gates or spouts. When the valves have once been regulated little additional attention in irrigation may be required. In the control stands a pressure gate placed on the upstream side may be used as shown in Fig. 1 or a simple slide gate may be used, set over the end of the outlet pipe. For the latter case the stand must be given a height greater than the pressure head in the pipe. This may require heights of stand of over 6 ft. in many cases. For such conditions pressure gates are preferable.

A number of types of stands and gates are found in practice. Instead of using the two sizes of pipe in the overflow system as shown in Fig. 1, a single size, usually 10 or 12 in. in diam-



Typical Pressure System

eter may be used. For pressure stands, the valve may be omitted and each stand capped, the control of the flow being secured entirely through the distributing gates or spouts. For such stands the spout gates are placed on the outside of the stand which requires heavier gates if leakage is to be prevented.

Present practice tends toward the use of the pressure system which stands as shown in the figure. This is due to the fact that much of the land now being planted is in the foothills or on slopes too steep for the overflow system. The pressure system is, however, being installed in many locations which are suited to either method. The distributing stands are more generally of the type shown in Fig. 1, when only 4 furrows are to be used, a typical practice. In soils which wash or where there are more than 4 furrows per stand the larger topped stands are used so that the distributing gates can be placed further apart and cross washing of the furrows prevented.

WESTERN ELECTRICAL ASSOCIATION MEETINGS

(The Pacific Coast Section of the National Electric Light Association is fast rounding into convention form. This gathering which is to be held at Riverside in April is creating interest to a marked degree throughout all sections of the territory involved. Below will be found many interesting and important details concerning the progress of the work now being carried on by the various section committees, followed by a complete list of Class A members.—The Editor.)

PACIFIC COAST SECTION CONVENTION AN ASSURED SUCCESS

The first annual convention of the Pacific Coast Section of the National Electric Light Association will be held at Riverside, California, April 19, 20 and 21. Riverside is half way between eastern New Mexico and northern California, conveniently reached from every town in the section and a point of great electrical and scenic interest.

A. B. West, vice-president of the Southern Sierra Power Company, who extended the invitation to meet at Riverside, has been appointed chairman of the convention committee, and with his associates has worked out a complete program of entertainment for the visitors.

Each of the standing committees has prepared a fine program of papers and reports, which will occupy every minute of the two days' business session and the general officers of the section have been enthusiastically at work to assure the general success of the meeting.

Plans are being made to care for at least two hundred electrical men from New Mexico, Arizona, Nevada and California. Each man is expected to bring his wife and family, if so fortunate, with the assurance that every provision has been made for the comfort and entertainment of the ladies.

The following program has been tentatively arranged:

Thursday, April 19th

8 to 10:30 a. m. Registration and reception of members.

10:30 a. m. Section called to order by president. Address of welcome by mayor and president of chamber of commerce; Response by John A. Britton. President's address. Reports from secretary and treasurer. Announcements.

2 to 5 p. m. Business session for members. Reception and card tournament for ladies. Organ recital in Cloister Glennwood Inn.

8 p. m. Address on Southern Sierras Power Company's system by C. O. Poole, illustrated by lantern slides. Musical entertainment.

Friday, April 20th

10 to 12:30 a. m. Business session for members.

2 to 5 p. m. Business session for members.

2 to 3 p. m. Auto drive for ladies.

3 to 5 p. m. Garden tea for ladies at Edgemont.

7 p. m. Banquet at Glennwood Inn for members and ladies.

9:30 p. m. Report of Public Policy Committee.

Saturday, April 21

9 to 12 a. m. Auto ride via Scenic Road to Redlands, visit Smiley Heights, thence to San Bernardino and over the Rim of the World road to crest of San Bernardino Mountains.

12 to 2 p. m. Luncheon at Pine Crest, given by Southern Sierras Power Company.

2 to 4:30 p. m. Return to Riverside, stopping at Southern Sierras Power Company's steam plant at San Bernardino and Southern California Edison Company's substation at Colton.

8:30 p. m. Ball at Glennwood Inn.

Sunday, April 22nd.

Such auto trips and other inspection visits as visitors may desire.

Engineering Committee

During the past month Chairman J. E. Woodbridge has had numerous conferences with members of his committee and called all together in one general meeting. As a result it has been decided to submit reports at the convention dealing with several specific problems of Pacific Coast interest. A complete account of progress in the investigation of porcelain as an insulator, legislation on line construction, standardization of pole line material, inductive interference, the safety code, transformer standardization and oil engines comprise the main topics under consideration. S. J. Lisberger is chairman of the sub-committee on Transformer Standardization; L. M. Klauber on Standardization of Pole Line Material, and J. E. Woodbridge on Inductive Interference.

Commercial Committee Meeting

Chairman S. V. Walton called a meeting of the Commercial Committee at San Francisco, February 14th. After a general discussion is was dedecided to devote one entire day at the Riverside meeting to the consideration of commercial problems under five general headings: (1) rates, (2) merchandizing of current consuming devices, (3) cooking and heating, (4) industrial uses, (5) commercial organization. The rate report will center around a paper on "Rates" by W. G. Vincent, with special contributions on the subject of rates for irrigation service. The merchandizing report will discuss cooperative methods of central stations and dealers. The main part of the cooking and heating report will consist of a comprehensive account of electric water heating tests. The committee will recommend the immediate preparation of a booklet on "Irrigation" as the most important industrial use of electricity in the West. There will also be a report on "Organization and Conduct of a New Business Department." Special attention will also be devoted to "Highway Lighting."

H. A. Lemmon is chairman of the sub-committee on Rates, J. B. Black on Cooking and Heating, A. W.

Childs on Merchandizing, E. B. Criddle on Organization, A. E. Holloway on Industrial Uses and E. B. Walthall on Highway Lighting. The next meeting of the committee will be on March 16th at Los Angeles.

Accounting Committee

Chairman B. F. Story is arranging for a special report on accounting methods to conform with the requirements of Western public service commissions.

Membership Committee

Chairman W. W. Briggs and his fellow committeemen are actively at work on a membership campaign which will insure at least a thousand Class B members in the Section by the time of the Riverside convention. A convincing pamphlet on the benefits of N. E. L. A. membership has been prepared by the committee and special efforts are being put forth to get every electrical man in the four states into the association.

Convention Committee

On Feb. 21 Chairman A. B. West called a meeting of the committee on arrangements for the convention at Los Angeles. The committee agreed upon the program as printed herewith and various subcommittees were appointed with the following chairmen: Attendance, W. L. Frost; Transportation, E. B. Strong; Reception, E. B. Walthall; Publicity, Henry Bostwick; Finance and Auditing, D. M. Speed; Entertainment, A. B. West. The transporation sub-committee has arranged for a fare and one-third rate on all railways and is planning on at least one special car to the convention from San Francisco. The committee will meet at Los Angeles on March 17th.

CLASS "A" MEMBERS PACIFIC COAST SECTION NATIONAL ELECTRIC LIGHT ASSOCIATION

Arizona

Bisbee—Bisbee Improvement Co., C. S. Thompson, Manager.
Clarkdale—Upper Verdi Public Utilities Co., R. C. Lane, Mgr.
Douglass—Douglass Improvement Co., R. G. Arthur, Manager.
Flagstaff—Flagstaff Electric Light Co., G. T. Herrington, Mgr.
Globe—Globe Light & Power Co., W. S. Sultan, Manager.
Kingman—Desert Power & Water Co., F. A. Wilde, Jr., Mgr.
Mesa—Southside Gas & Electric Co., H. L. Chandler, Manager.
Miami—Miami El. Light, Tel. & Water Co., L. Van Dyke, Mgr.
Nogales—International Gas Co., S. S. Proto, President.
Nogales—Nogales Elec. Lt., Ice & Water Co., F. A. Faust, Supt.
Phoenix—Pacific Gas & Electric Co., H. L. Aller, Manager.
Prescott—Prescott Gas & Electric Co., M. V. Watson, Mgr.
Tucson—Tucson Gas, El. Lt. & Pwr. Co., F. G. Russell, Mgr.
Williams—Williams Water & Elec. Co., Luther Stover, Mgr.

California

Fresno—San Joaquin Light & Power Corp., A. G. Wishon, Mgr.
Hanford—H. G. Lacey Co.
Los Angeles—Los Angeles Gas & Elec. Co., Wm. Baurhyte, Vice-President.
Los Angeles—Pacific Light & Power Corp., G. C. Ward, V.-Pres.
Los Angeles—Southern Cal. Edison Co., W. A. Brackenridge, Vice-President and General Manager.
Oceanside—Oceanside Elec. & Gas Co., A. S. Hargreaves, Mgr.
Ontario—Ontario Power Co., G. D. Smith.
Riverside—Southern Sierras Power Co., A. B. West, Vice-Pres.
San Diego—San Diego Cons. Gas. & El. Co., H. H. Jones, Mgr.
San Francisco—California Oregon Power Co., J. D. Grant, Pres.
San Francisco—Coast Counties Gas & Electric Co., S. W. Coleman, President and Manager.
San Francisco—Great Western Power Co., W. W. Briggs, General Agent.
San Francisco—Northern California Power Co., W. F. Detert,
San Francisco—Pacific Gas & Electric Co., J. A. Britton, Vice-President and General Manager.
San Francisco—Sierra & San Francisco P. Co., H. F. Jackson, President.
Sonora—Tuolumne County Elec. Power & Lt. Co., H. J. Coffill, Manager.
Stockton—Western States Gas & Elec. Co., Sam'l Kahn, Vice-President and General Manager.
Visalia—Mt. Whitney Power Co., B. M. Maddox, Vice-Pres.
Turlock—Yosemite Power Co., P. M. Longan, Manager.

Nevada

Elko—Elko-Lamoille Power Co., B. G. McBride, General Mgr.
Ely—Ely Light & Power Co., Arthur Smith, General Manager.
Goldfield—Nevada-California Power Co., F. B. Mechling, General Manager.
Reno—Truckee River Gen. El. Co., Geo. A. Campbell, Gen, Mgr.
Lovelock—Lovelock & Woolsey Lt. & Power Co., S. R. Young, General Manager.

New Mexico

Albuquerque—Albuquerque Gas, Electric Light & Power Co., W. P. Southard, Manager.
Carrizozo—Lincoln Co., Lt. & Pwr. Co., J. E. Wright, Manager.
Carlsbad—The Public Utilities Co., E. A. Roberts, Manager.
Deming—Deming Ice & Elec. Co., J. A. Shepard, Manager.
Gallup—Citizens Lt., Power & Teleg. Co., K. H. Meyers, Mgr.
Las Vegas—Las Vegas Lt. & Power Co., W. S. Townsend, Mgr.
Lordsburg—Lordsburg Elec. Co., W. F. Ritter, Manager.
Las Cruces—Las Cruces El. Lt. & P. Co., D. W. Morgan, Mgr.
Raton—Raton Elec. Light & Pwr. Co., J. R. Smith, Manager.
Roswell—Roswell Gas & Elec. Co., C. M. Einhart, Manager.
Santa Fe—Santa Fe Water & Lt. Co., Frank Owen, Manager.
Silver City—Silver City Power Co., M. R. Buchanan, Manager.

AN UNUSUAL LEAKAGE PHENOMENON

Sir:—We send you herewith a photograph which may be of interest for your "Sparks" column. This shows the effect of an 11,000-volt wire having dropped on clayey soil and the consequent flow of leakage or charging current (the

Baked Clay for Short-Circuiting an 11,000-Volt Line

system being normally ungrounded) has baked a piece of pottery as shown. This piece will ring like a sound insulator. Evidently the current has followed the roots of some weed, thus causing the particular root-like form shown.

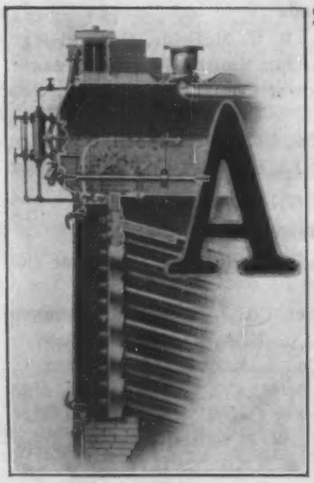
L. M. KLAUBER,
Supt. Elec. Dept. San Diego Con. Gas & Elec. Co.

FUEL OIL AND STEAM ENGINEERING

(Steam and water play an important role in fuel oil practice. In order that the student may grasp the fundamental principle whereby heat is first absorbed by water in the boiler and still more heat absorbed, when steam is formed and later superheated, he must understand the laws governing heat absorption. In this article the author sets forth the fundamental principles involved in the making of saturated and superheated steam. A formula is deduced for computing the total heat of saturated steam which, though simple, is of great importance in fuel oil and steam enginering practice and will be the basis from which more intricate laws will be later deduced.—The Editor.)

WATER AND STEAM IN FUEL OIL PRACTICE

BY ROBERT SIBLEY



A Typical Boiler Setting in Fuel Oil Practice

As we look about us in nature, we find that all inanimate creation presents itself to us in three distinct physical states. Certain bodies, for instance, of themselves readily maintain their shape while others, although non variant in density, nevertheless seem to have no particular physical configuration but seek, due to the force of gravitation, the lowest level attainable and consequently must as a rule be held in a containing vessel. On the other hand, a third class of bodies is found not only possessing no particular physical configuration, but which actually seem inherently desirous of expanding to such an extent that they must as a rule be completely housed, bottom and top, in a containing vessel.

In the class room or in the power plant, it is easy to find illustrations of these three general classifications. Thus, chalk, iron pipe, and coal are instances of the first division and are known as solids. Crude petroleum, water, and kerosene are instances of the second division, and are called liquids. Finally, air, steam, and producer gas illustrate the third division, and are called gases.

These States are Possible to all Bodies.—The most interesting thing about these socalled states of matter, and indeed the item of most importance to the engineer, is that by varying the pressure externally forcing itself against the sides of any one of these bodies and by adding or subtracting the heat that may be held in store within the body itself, any solid may be converted into a liquid and then into a gas, or any liquid may be converted into a solid or a gas, or any gas may be converted into a liquid then into a solid.

The Fundamental Principle in Steam Engineering.—It is this property of matter that makes the operation of the steam engine possible. For if we were not able to heat water and convert it into steam, it would be impossible to make use of this liquid for steam engineering purposes, although it is the most widely distributed in nature.

Again, since fuel oil must be converted into the gaseous state before it readily and efficiently burns beneath the boiler, it would certainly be cumbersome and impractical for its use in the great majority of central stations if it could not be conveyed through pipes or in oil tanks as a liquid from the oil fields to the place of consumption.

Steam Engineering Still Supreme.—Since water is so widely disseminated in nature and since it can be readily and efficiently changed from one state to another, it is the working substance that today still drives the vast majority of power developing mechanisms in the industries in spite of the rise of the gas engine and the great modern evolution in water power development.

Let us then trace the physical phenomena that accompany the transformation of water into the solid state which of course is necessary in the production of ice, and again from the liquid to the gaseous state which becomes necessary in the production of steam.

The Formation of Ice.—Let us first start with a pound of water at ordinary temperatures—say at 62° F. As we begin to lower the temperature, in other words to draw off heat, the volume slightly decreases. Thus the pound of water now occupies less space than formerly. Hence, if this water was on the surface of a mountain lake and the night was getting cooler, the surface water would sink to the lake bottom and allow warmer water from the bottom to rise only to be cooled at the surface to again drop to the bottom. This is what is known as water circulation and is very important in steam generation, as we shall see later.

When, however, the water under consideration lowers to a temperature of 39.4° F., a strange thing happens. Something develops in its internal structure that now makes the water expand as the temperature is further lowered. A unit volume of water now becoming lighter than formerly, no longer will it sink to the lake bottom but remains on the surface. Hence when a short time later the water on the surface is lowered to 32° F. or freezing point, ice is formed on the surface only, since water is a poor conductor of heat. Nature thus protects the fish in the waters below.

Coming back from the mountain lake, however, to the formation of ice in the ice plant, when the temperature has reached 32° F., although heat be now driven off, the water does not lower itself in temper-

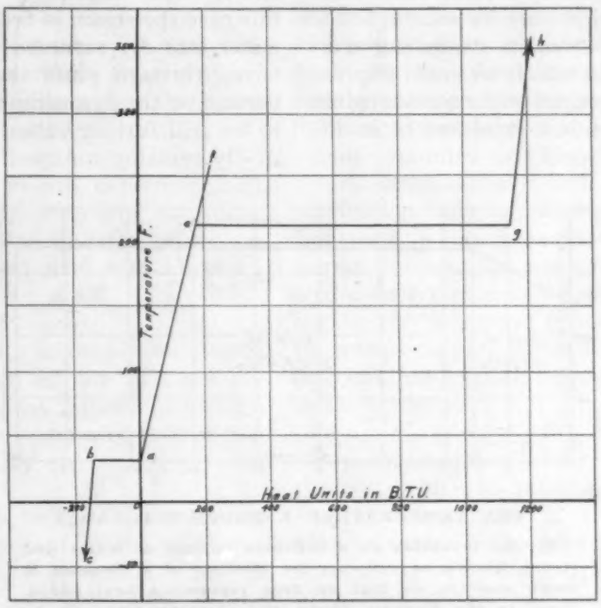
ature but remains at this temperature until it has all been converted into ice.

Latent Heat of Fusion.—The quantity of heat necessary to form one pound of ice at 32° F. from one pound of water at 32° F. is a definite measurable quantity and is known as the latent heat of fusion. By careful measurement, the latent heat of fusion for water has been found to be 142 B.t.u. That is, to convert one pound of water at 32° F. into ice at 32° F. requires the drawing off of as much heat as would approximately be required to lower one pound of water one hundred forty-two degrees in temperature.

When this pound of water is converted into ice, its volume still further expands. Hence, one pound of ice will float in water. This accounts, of course, for the floating of icebergs on the water surface, and furthermore this sudden increase in volume accounts for the rupture in pipes and other nuisances that occur in severely cold weather.

Going back to our pound of water now converted into a pound of ice, let us again proceed to draw off heat. It is now found that we may lower the temperature of the ice much more easily than when it existed as a liquid. Indeed only about one-half the heat is required per degree lowering in temperature while its volume practically remains constant.

The Formation of Steam.—Let us now proceed to a consideration of the physical changes and phenomena that occur when water passes into steam. Starting with water at say 62° F., as we add heat the temperature increases at the rate of about 1° F. for every unit of heat energy added to the water. At the same time the volume slightly increases. Hence, if our pound of water under consideration be situated at the bottom of the well-known tea-kettle, the observation of which led James Watt to the invention of the steam engine, this pound of water becoming now less dense will rise to the top and cooler water at the top will sink to the bottom which in turn is passed again to the top as it becomes heated to make way for more water from the top to be heated along the portion exposed to the heat application. Thus the water becomes warmer and warmer and the transference from bottom to top continues. The ease with which this transfer of heated bodies of water takes place has much to do with efficient operation of the steam boiler which may be likened to an enlarged tea-kettle with accessories and appurtenances to care for its increased responsibilities as compared to tea-kettle operation.



THE TEMPERATURE HEAT DIAGRAM

Here is graphically indicated the history of a pound of water in its relationship with temperature and heat. Beginning at 32 deg. F. and atmospheric pressure, by drawing off heat the horizontal line ab is traced, showing that the temperature remains constant until the water is completely converted into ice, after which the temperature rapidly falls at the rate of about one degree for every half unit of heat drawn away. By the addition of heat, however, at point a, the curve ae is traced, which indicates that the temperature rises with absorption of heat at the approximate rate of one degree for each unit of heat absorbed. At 212 deg. F. and atmospheric pressure the horizontal line eg is traced until 970.4 B.t.u. are absorbed. After all the water is thus converted into steam the curve gh is traced for superheated steam, which rises at the rate of about one degree for every .47th of a B.t.u. absorbed.

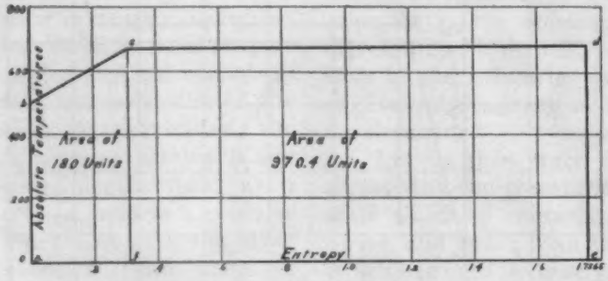
Latent Heat of Evaporation.—The water in this manner continues to absorb heat until if under atmospheric pressure, it reaches a temperature of 212° F. At this point, however, vast quantities of heat may be added and still the water will remain at this temperature although it may now be observed that steam is being formed which too, has the same temperature as the water. Not until 970.4 B.t.u. or sufficient heat units to raise ten pounds of water almost one hundred degrees in temperature have been added to the pound of water at 212° F. will the pound of water become entirely converted into steam at 212° F. This quantity of heat necessary is important in steam engineering and is known as the latent heat of evaporation for water under atmospheric pressure conditions. To be succinct, in steam engineering practice the quantity of heat necessary to convert one pound of water at a given temperature and pressure into dry steam at the same temperature and pressure is known as the latent heat of evaporation for that temperature and pressure and is usually expressed by the symbol L_t. Steam boilers seldom operate at a pressure so low as that of atmospheric conditions. Indeed, while such a pressure is but 14.7 lb per sq. in., the modern boiler in the central station operates at something like ten to fifteen times this pressure. This fact materially complicates computation in steam engineering, for it is found that at pressures different than that of standard atmospheric conditions the latent heat of evaporation is wholly different. Indeed, so complex is this law of variation that no one as yet has been able to give an exact formula for its determination, although in subsequent chapters approximate equations will be set forth. Hence, it has become necessary to refer to carefully compiled steam tables for such information and a later chapter will set forth the manner of their use.

Other Variations Occur With Changes of Pressure.—When water passes into steam, the volume—say of one pound—vastly increases. At atmospheric pressure the volume of steam is about sixteen hundred times what it was when existing as water. At other pressures the volume relationships will of course be different. Again when the pressure increases at which steam is formed, the volume be-

comes less in proportion. No accurate mathematical formula has been found for this relationship, hence once again must we appeal to the steam tables.

Data Easily Taken from Steam Tables.—By experiment it has been found that varying amounts of heat are required to raise water from a particular initial temperature to the boiling point, for the boiling point is not reached until a higher temperature is attained as the pressure is increased. On the other hand, less heat is required to convert a pound of water at these higher boiling points into steam. Since the volume and density too vary under varying pressures, the entire problem now becomes one of picking the proper constants for the particular temperature and pressure under discussion and when one by a little practice can use the steam tables with facility, it is surprising to see how simply and directly most problems in steam computation may be solved.

Total Heat of Steam.—Often in steam engineering practice problems arise in which we must express the total heat of steam quantitatively represented in each pound under consideration. It makes little difference at what point we begin to estimate such heat relationships, but by common consent the freezing point of water has been adopted. Hence, the total heat of steam is the heat required to raise one pound of water from 32° F. to the boiling point added to the heat required to convert this water into steam at that temperature. If the steam exist as superheated steam, there must also be added the heat required to raise dry saturated steam to the temperature of superheat. The various mathematical formulas for computing these numerical results will be taken up later in the chapter entitled Quality of Steam.



THE TEMPERATURE ENTROPY DIAGRAM

By the invention of a fictitious quality of water and steam, known as entropy, the plotting of a diagram is made possible, so that an area represents heat added. Thus, in the diagram above, the abscissas are entropy and the ordinates absolute temperatures. The area abcf is exactly 180 units, which is the heat required to raise water from 32 deg. F. to 212 deg. F. Similarly, the area fcde is 970.4 units, which is the heat required to evaporate one pound of water at 212 deg. F. into steam at 212 deg. F.

At this particular time we shall write down the simplest of these formulas as an illustration.

Total Heat of Dry Saturated Steam.—The total heat of dry saturated steam, written **H**, for a given temperature **t**, is the sum of the heat of liquid and latent heat of evaporization for that temperature.

Hence we may write this important fundamental equation

$$H_t = h_t + L_t \quad \ldots\ldots (1)$$

Thus the total heat of steam at 212° F. is

$$H_t = 180 + 970.4 = 1050.4 \text{ B.t.u.}$$

Other Instances of Total Heats.—If, however, the steam is evaporated from the water and then superheated, that is, an additional quantity of heat is added after all the water has become steam, it will then begin to rise in temperature and the quantity of heat necessary for each degree rise in temperature is about one-half that required per degree rise when it existed as water. This exact ratio is however quite variable and ranges between .46 and .60 depending upon the pressure and degree of superheat attained. Hence once again appears the necessity of steam tables.

It is now readily seen that in general three definite and distinct considerations present themselves in the solution of problems involving the computation of total heat. The first instance is one in which the steam exists in a dry state and at the temperature and pressure at which it is generated from the water. Such steam is known as dry saturated steam. The second instance is that in which the steam is not completely dry, but holds in suspension small particles or globules of water, and in this instance the mixture is known as wet saturated steam. The third instance is of especial importance in modern central station practice and involves what is known as superheated steam. In this case the steam is first formed by evaporation from water into dry saturated steam, after which it is conveyed through pipes that are exposed to high temperatures, thus causing the temperature of the steam to be still further raised, although the pressure practically remains constant.

The complete solution of these three instances for computation of total heats will be found in the chapter on Quality of Steam as stated above. Meanwhile the thorough mastery of the fundamentals of the physical properties of water as herein set forth will be of vast assistance in a clear understanding of this later discussion.

Examples

1. The water entering a feedwater heater is at a temperature of 75° F. and leaves the heater at 190° F., what is the heat absorbed per lb. of water?

From the steam tables the heat of liquid at 75° F. is 43.05 B.t.u. and at 190° F. it is 157.91 B.t.u. Hence the heat absorbed per lb. of water is

$$157.91 - 43.05 = 114.86 \text{ B.t.u.}$$—**Ans.**

2. Water enters a boiler at 160° F. and is converted into dry saturated steam at 200 lb. pres. per sq. in. abs., what is the total heat required to evaporate each lb. of steam?

The heat in the entering water at 160° F. is from the steam tables 127.86 B.t.u. The total heat of dry saturated steam at 200 lb. pres. abs., is 1198.1 B.t.u. Hence the actual heat necessary to evaporate each lb. of steam is

$$1198.10 - 127.86 = 1070.24 \text{ B.t.u.}$$—**Ans.**

3. If the heat of liquid for boiling water at 212° F. is 180 B.t.u. and the latent heat of evaporation is 970.4 B.t.u., how much heat is required to evaporate a pound of water from an open water heater which is receiving its supply at 64° F.?

Each lb. of water entering at 64° F. has a heat of liquid of 32.07 B.t.u. Water evaporating into steam at 212° F. has a heat of liquid of 180 and a latent heat of evaporation of 970.4 B.t.u., making a total heat of evaporation of 1150.4 B.t.u. for every lb. of water so evaporated. Hence the net heat required is $1150.40 - 32.07 = 1128.33$ B.t.u.—**Ans.**

SPARKS—Current Facts, Figures and Fancy

(New applications of electrical energy and new methods of generating this vital fluid are to be found in the following lines. Other facts, figures and fancy also to be found below may serve their purpose, too, in giving you inspiration for more effective work in your particular line of activity.—The Editor.)

Far less than one per cent of the homes in the country are wired for complete electric service.

* * *

There is a movement on foot to standardize catalog copy into one master catalog for the purpose of saving paper and for bringing about other economies that are self-apparent.

* * *

Due to the unprecedented advance in electrical invention it is now possible to obtain over a thousand per cent more of electric light for the same money than it was twenty years ago.

* * *

January was the coldest month experienced in California for a period of twenty-one years, according to the Weather Bureau. It was a little severe on civilians, but the central station man was observed to wear a happy smile throughout it all.

* * *

Of the twenty million homes in the United States it is estimated that fully fifteen million of them are yet unwired for electric service. A gigantic campaign is now on the country over to materially reduce this vast field at present unserved by electricity.

* * *

If you are new on the job be careful. Statistics show that more than forty per cent of the employes injured in several public utility companies, and in one large company sixty-two per cent were in the service of the company less than one year when injured.

* * * *

A geological map of California has just been issued by the state mineralogist, which shows not only the geological features of the state, but also the railways, state highways and other roads, electric transmission lines, oil and gas pipe lines, and a host of other useful information.

* * *

The winds of Pacific lands have often been harnessed for water pumping but little application has been made for generating electric power. Now that a Wisconsin inventor has successfully accomplished this feat, it would seem that inventors of the West might well apply their genius in carrying this problem further in the solution of Western needs.

* * *

Ships making the transit through the Panama Canal during December were divided by nationalities as follows: British, 63; United States, 37; Norwegian, 15; Chilean, 8; Peruvian, 7; Dutch, 6; Japanese, 5; Danish, 4; Costa Rican, 3; Swedish, 3; Spanish, 2; Cuban, 1; Mexican, 1. Traffic was greater by seven ships and 47,610 net tons, Panama Canal measurement, than for the month of November.

Over one hundred million incandescent lamps are now sold annually or more than sufficient to illuminate an array of mile posts from the earth to the sun.

* * *

Fifteen hundred employes and associates participated recently in assisting Thomas A. Edison to celebrate his seventieth birthday. If each one present had insisted on the traditional "hearty spank for each year with one to grow on," the famous inventor would undoubtedly have been forced to put out a new multiform protector of some sort under such a broadside from an assemblage of this proportion.

* * *

A comparatively little known but valuable tree most often called a slash pine is fast replacing longleaf pine in many sections of the South, says the Forest Service. In some respects this tree is considered a better tree than longleaf. Its growth, according to the foresters, is more rapid and its yield of turpentine larger, while the wood is said to be the heaviest, hardest and strongest coniferous wood grown in the country.

* * *

German agricultural reports show that by feeding the soil with two million tons of nitrate there was secured an increase in crops of sixty-three million tons. Current authorities agree that one and one-half horsepower of hydroelectric energy will produce a ton of sodium nitrate per year. Gigantic water powers are available in the West and this possible increase in fertility of the soil is a very happy source of contemplation for the Western power owner and for the agriculturist.

* * *

That excessive profits are to be prevented in the event of hostilities is indicated by the fact that the Council of National Defense has called on the Chamber of Commerce of the United States for assistance and advice in purchases to be made by the army quartermasters. The National Chamber recently passed a resolution providing that the basis of supply of government requirements in war and peace from private sources should be at a rate of profit so low as to preclude a profit interest in war.

* * *

Electricity has been found to have a new function other than to light the world and make the wheels of industry go round. According to Professor Silas Wentworth, stock grower of Los Gatos, it can be used to make two or three sheep grow where only one grew before. Professor Wentworth reports that because the heavily charged lines of the Great Western Power Company extend across the farm of Librarian John F. Tyler of the State Supreme Court, new-born lambs on the Tyler ranch are coming in triplets and twins.

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Selling the Electrical Idea

The recent census statistics that show forty farmers of the Middle West as owning forty automobiles while bath tubs to the number of three were all that could be inventoried among the group, brings to light a very important psychological point in salesmanship. The idea of the automobile has been sold the country over while the idea of the bath tub is evidently wofully in the background, or else totally absent in some instances at least. The nation is becoming more and more "sold" to the electrical idea. Co-operation is working wonders in every section of the country. The splendid results that are daily coming in bear out the fact that it is this national idea that must be emphasized in all advertising and not the individual self-centered idea that formerly was uppermost in the minds of men of the industry. Putting over the electrical idea in true hand to hand co-operation, devoid of cut-throat competitive small bickerings, is indeed worthy the aim of those far-sighted captains of industry now engaged in forwarding this important phase of modern industrial life.

American Non-use of Metric System

The non-use of the metric system in the United States among engineers and among the trade is beginning to be felt as a serious handicap in American efforts to secure a commercial and engineering foothold in South America.

Our consular reports are full of statements to this effect. Take for instance the greatest republic of South America. Brazilians are unfavorably impressed when they receive commercial correspondence in which references are made to feet, yards, and miles, instead of the meters and kilometers to which they are accustomed. Within the past decade there has been a strong tendency in American export trade to encourage the employment of invoice clerks who make out documents not only in the language but also in the measurements of the country to which the goods are directed.

Details of the practice among business houses in various lines in Rio de Janeiro have been obtained by the American consulate general and show how important it is that exporters should pay special attention to this phase of the commerce between nations.

Now is the time for engineers the country over to exert every influence in promoting the use of the metric system at home and abroad.

And the best way to do this is for each one of us to begin to think and act in this system of units and put aside our outgrown garments of feet, inches, pounds, yards and the like, and speak only in metric units, the now recognized scientific system of all enlightened nations.

Familiarity With Foreign Exchange a Necessity

Engineers of the West have long since accustomed themselves to all the necessary forms of credit systems of American banking institutions at home. Little attention has, however, been given to methods in vogue in the foreign exchange. Not until the engineer endeavors to connect up with the home office when out on his first foreign business visitation does he find how wholly ig-

norant he is on the subject and indeed how lacking American banking facilities are in the countries bordering the Pacific.

This one feature in our modern commercial and engineering life has done much in retarding American engineering activities in these countries.

Rapid strides are being made by the Federal Reserve Commission at Washington to better this state of affairs. The leading article of this issue is devoted to a discussion of this phase of recent progress in banking facilities by a well-known Western authority on foreign exchange methods.

Engineers of the West can do much in still further increasing banking facilities and incidentally commercial and engineering interchange with our Pacific Coast neighbors by giving this matter their thoughtful attention and endorsing every worthy move that is being made to forward American banking representation in these lands.

Lack of Accountancy in Electrical Contracting

Commercial specialists at Washington who have been investigating the cause of business failure have come to the conclusion that in a large majority of instances this disaster has occurred due to the lack of knowledge on the part of the operator as to the exact status of his business. Investigation into failures among electrical contractors and other branches of the electrical industry has found this lack of business knowledge in accountancy to be especially glaring.

Ignorance of proper methods of computing and making allowances for depreciation and overhead segregations has been the death knell of many a promising young business institution in this industry.

The need for this knowledge is most pressing. The present rather warped profits that are possible due to abnormal conditions in the buying world are especially to be allowed for with due discretion otherwise disaster is bound to occur on the downward decline of prices of material that are sure to come.

The most casual consideration of the matter shows a gross lack of knowledge in accountancy among men of the industry. This lack of knowledge could be remedied in many instances in the electrical industry in so far as the future is concerned by remodeling to a certain extent the curricula of technical institutions whence these young men acquire their training.

The need for accountancy in engineering is each day growing more emphatic and the somewhat lessening need for men of otherwise highly technicalized training is each day becoming more self evident. Hence it must be admitted that the young engineer to be a success must be prepared to handle fundamental considerations in accountancy, even if training in highly specialized subjects must consequently be somewhat neglected.

More and more it is becoming evident as time goes on that the essential training needed for the young engineer should consist of thorough versing in business method and a thorough grounding in the fundamental laws of mathematics, chemistry and physics.

Prepared in this manner the young engineer can successfully cope with practically any problem that may arise, while the young man who spends too much time in highly specialized subjects in his undergraduate days at college will find himself unable to handle the highly diversified subjects that arise in the daily life of the man in the engineering profession or engaged in the various problems that arise in the electrical industry.

A Research Agency Needed

The problems in development of domestic water supply in cities of the West are fast assuming nation-wide proportions at least in so far as notoriety and investment of capital involved are concerned. Especially is this true among what are known as the Bay Cities of California—San Francisco, Oakland, Berkeley, Alameda, Richmond and other communities. It is truly surprising to note with what fervor each distinct community is putting forth its pet mountain supply or other source as the one and only one to be considered.

The entire problem is intricately interwoven with the future of hydroelectric development on the Pacific Coast for many of the proposed domestic supply projects involve the ultimate development of gigantic water powers as side issues.

Since these cities are growing by leaps and bounds, practically every engineer who has familiarized himself with the conditions to be met will agree that the local sources, fully developed, at best will prove adequate for less than a score of years ahead.

The problem, then, necessitates the wisest foresight possible. To develop an adequate supply for a fifty-year period hence for all the bay cities combined will call for an investment of something like a hundred million dollars.

To mention this amount of money in one breath is one thing and to raise this sum is another. Every advance in modern engineering accomplishment has brought out one noteworthy fact that unity in development, free from duplication or paralleling of effort, is a fundamental economic principle emphatically to be borne in mind.

The time has come in the development of community of interest in these cities of California that engineers be employed to assist in judiciary advice.

It is clearly the duty of the Railroad Commission to bear this idea of unity of development in mind when determining the necessity of public convenience experienced in proposed enlarged expenditures of public funds now before it for consideration. While the commission itself, due to its judiciary functions may not feel it should actively formulate a body of independent investigators for this enlarged activity, still every industry, every agricultural development, every power company from the Tehachapi to Mt. Shasta is shaken to its very depths in one way or another by some of the schemes proposed for these enterprises.

A free and above-board citizens' agency formed to give this problem an impartial research investigation is the crying need of the hour. And the people of California as a whole would welcome such a move made by the Railroad Commission and other bodies before whom these problems must ultimately come for adjudication.

PERSONALS

C. R. Rudy, salesmanager of the Colorado Power Company, has returned to Denver from a visit to California.

George R. Murphy of the Electric Storage Battery Company, has left San Francisco for a trip through Nevada.

Guy W. Talbot, president of the Pacific Power & Light Company of Portland is spending a few weeks in California.

Geo. A. Wardlaw, editor of the Electrical Record since 1910, resigned that position on March 1 in order to engage in free lance literary work.

J. C. Zancker, northwest manager of the Federal Sign Company (Electric) with headquarters at Portland, was a recent San Francisco visitor.

Thos. G. Bradley, superintendent of plants for the California-Oregon Power Company, has been at San Francisco from Medford and Yreka.

Carl G. Schluederberg, assistant manager of the supply partment of the Westinghouse Electric Manufacturing Company, was at San Francisco recently.

Edward D. Pike of the San Francisco office of the Wagner Electric Manufacturing Company's office in San Francisco has left for an extended trip throughout the East.

Harry Whiting, president of Pierson, Roeding & Company, has left San Francisco for Del Monte and the southern part of the state partly on business and partly on pleasure bent.

C. E. Ingalls, formerly connected with the Crocker-Wheeler Company's Los Angeles office, who has more recently been with the company in the East, has just been transferred to the San Francisco office.

C. S. Hull, of the testing laboratory of the General Electric Company in San Francisco has left for Ajo, Arizona, where he will assist in the testing out of the new Cornelia Copper Company's power plant at that place.

J. B. Estabrook, secretary of The Peerless Electric Company having spent part of the winter at Phoenix, Ariz., has made a recent visit to Los Angeles and San Francisco and is now back at the company headquarters in Warren, Ohio.

C. S. Thompson, advertising manager of the Western Electric Company, is an interested visitor on the Pacific Coast where he gave a recent stirring address before the electrical men of San Francisco on national electrical advertising.

Harry Kluegel, formerly engaged with the adjudication of the water rights of the Mt. Whitney Power Company and more recently from Denver, where he has been investigating the water supply for that city, has returned to San Francisco for permanent residence.

C. H. Judson, special engineer for the Pacific Telephone & Telegraph Company, recently delivered a very interesting lecture before the Stanford University section of the American Institute of Electrical Engineers on "A Modern Telephone Exchange and of What It Consists."

W. S. Mendenhall has resigned his position as commercial manager of the Grays Harbor Railway & Light Company, at Aberdeen, Wash., to engage in the printing business under the firm name of Welch-Richards Printing Company. **C. Hugo Nelson** succeeds Mr. Mendenhall as commercial manager of the company.

Dwight D. Miller has joined the staff of The Society for Electrical Development, for the particular purpose of further developing the various uses of electricity in the different industries. The work of the society has grown to a point where it has become necessary to add another engineer to its staff engaged in this field.

department of the Westinghouse Electric Manufacturing Com-

A. H. Halloran, vice-president and managing editor of the Journal of Electricity, has returned from Reno, Nevada, where he went in connection with the organization of a Nevada subdivision of the Pacific Coast Section of the N. E. L. A., which has been successfully consummated.

C. R. Weymouth, chief engineer of Chas. C. Moore & Company, has left San Francisco for Ajo, Arizona, where he will spend some days in testing out the new Cornelia Copper Company's power plant at that place: This plant establishes a new high record for boiler operation on the Pacific Coast as it will operate under 250 lb. pressure.

J. W. Finch, formerly commercial agent of the Southern Sierras Power Company at Riverside, California, has left on a tour of all the Central and South American west coast countries in the interests of commercial and engineering investigations for a number of principals in Los Angeles, San Francisco and other Pacific Coast cities. Mr. Finch expects to be gone twelve months.

A. P. Ramstedt, former president of the Public Utilities Commission of the State of Idaho, has resigned as a member of the commission to accept the position of general auditor and comptroller of the Day mining interests, including among others, the Hercules Mining Company, Tamarack & Custer Consolidated Mining Company and other mining companies in Idaho and British Columbia; the Northport Smelting & Refining Company at Northport, Washington; Pennsylvania Smelting Company at Pittsburg. Pennsylvania, and various banking interests in Idaho and Washington.

John A. Britton, vice-president and general manager; **D. H. Foote,** secretary; **F. G. Baum,** consulting engineer; **P. M. Downing.** chief engineer in the hydroelectric department; **Henry Bostwick,** assistant to the vice-president; **J. P. Jollyman,** engineer in charge of electric construction, and **W. G. Vincent,** valuation engineer, of the Pacific Gas & Electric Company; **William Doble,** chief engineer, and **C. S. Foulds** of the testing department of the Pelton Water Wheel Company, and **Robert Sibley,** editor of the Journal of Electricity, were among the prominent engineers that witnessed the putting in of the Wise Power Plant of the Pacific Gas & Electric Company at Auburn, California, on Sunday, March 4, 1917.

Ben B. Bessesen, mechanical draftsman, Brinkley Supply Co., Seattle, Wash.; **Claude Charles Brown,** assistant boiler room engineer, Station "A", Pacific Gas & Electric Co., San Francisco, Cal.; **Harry Boyd Dunlap,** oil flotation operator, Nevada Consolidated Copper Co., McGill, Nev.; **William Mowry Holmes,** estimator of transmission line construction, Pacific Light & Power Corporation, Los Angeles, Cal.; **Frederick Krug,** in charge of electrical equipment, and student, New Mexico State School Mines, Secorro, N. M.; **Charles Goodell Marcy,** student engineer, General Electric Co., Montesano, Wash.; **Thomas Edward Marcum,** operator, Anaconda Copper Mining Co., Great Falls, Mont.; **John Donald Pollock,** engineer Pacific Telephone & Telegraph Co., Portland, Ore.; **Henry G. Roberts,** electrician, Canadian Consolidated Mining Co, Trail, B. C.; **Claude W. Sprague,** operator, B. & M. Smelter, Great Falls, Mont.; **Carl Orrin West,** engineering department, Home Telephone & Telegraph Co., Los Angeles, Cal., and **Adolph Frank Wolff,** substation operator, Spokane and Inland Empire Railway Co., Spokane, Wash., have been elected associates of the American Institute of Electrical Engineers.

OBITUARY.

The officers of the Habirshaw Electric Cable Company, Inc., announce with profound sorrow and deepest grief the passing of their vice-president, Captain Richard S. Satterlee, on February 15th.

B. F. Kieruiff, president of Kieruiff & Co. at Los Angeles, Cal., passed away on March 8th. Mr. Kieruiff, a product of California and its educational institutions, leaves a host of friends, who deeply mourn his loss.

MEETING NOTICES FOR ELECTRICAL MEN

(In the following lines meetings and personal items of current interest to engineers are recorded. Efficiency study, accounting, demand meters, a discussion of California electrical utilization safety orders and other subjects have been discussed during the past two-week interval by gatherings in various Pacific Coast cities. In this issue the Journal also commences a list of Builders of The West to commemorate its thirtieth or jubilee year of publication among engineering periodicals. The first builder to be recorded is Benjamin Ide Wheeler, the much respected and beloved president of the University of California.—The Editor.)

San Francisco Section of A. I. E. E.

The San Francisco Section of the American Institute of Electrical Engineers met at the Engineer's Club Rooms on Friday evening, February 23. The subject of the evening was "Demand Meters" and the paper presenting this subject was read by W. A. Hillebrand of the Pacific Gas & Electric Company. The speaker discussed the development of the demand meter and illustrated his discussion with a series of slides. The attendance was eighty.

Address at the Engineer's Club of San Francisco

At Friday noon of March 2, 1917, Minor Chipman of Boston, an efficiency expert, gave a most interesting address before an assemblage of eighty members on the subject of "Efficiency Study." The speaker traced the development of efficiency investigations from the early deductions of the Taylor researches down to the present time.

Scientific Societies to Meet at Stanford University in April

The second annual meeting of the Pacific Division of the American Association for the Advancement of Science will be held this year at Stanford University during the period, April 4 to 7. Among the scientific societies which will also convene in conjunction with this meeting are the Astronomical Society of the Pacific, the Pacific Coast Section of the American Mathematical Society, the American Physical Society, the California Section of the American Chemical Society, the Cordilleran Section of the Geological Society of America, the Seismological Society of America, the Pacific Coast Branch of the Palaeontological Society, the Western Society of Naturalists, the Cooper Ornithological Club, the Pacific Slope Branch of the American Association of Economic Entomologists, and the California Academy of Sciences. Sessions of these societies will be held on Thursday, Friday, and Saturday of the period of the convocation.

Bi-Weekly Luncheon of Joint Sections of the A. I. E. E. and N. E. L. A. with Oregon Society of Engineers

This meeting was held in the orange room of the Oregon Hotel, February 28th, A. S. Moody was chairman and the luncheon was in charge of the Pacific States Electric Company. After the luncheon, the meeting adjourned to the Columbia Theater where a motion picture film, "The King of the Rails," was shown. This film showed the history and development of railroad industries, concluding with the electrification of the Milwaukee railroad over the Rocky mountains. Seventy were in attendance.

Oregon Society of Engineers

The regular monthly meeting of the Society was held in Library Hall, February 27, at 8 o'clock. A three-reel feature film illustrating the manufacture of steel pipe was shown and explained by O. M. Ash.

Every process in the manufacture, from the mining to the finished product was dealt with. The picture was also shown to promote the welfare work undertaken by large corporations.

BUILDERS OF THE WEST—I

BENJAMIN IDE WHEELER

The Journal of Electricity now in its jubilee year of "Thirty Years of Service," takes pleasure in recording for all posterity to read the names of the distinguished educators, executives and engineers who have been the life-giving element in building up the unprecedented engineering accomplishments of the West.

A character builder is indeed one of the highest callings that can befall the engineer. Here is a man who through classic culture has broadened the lives of men and indeed actually produced under his supervision more engineers of the West than any other living soul. Benjamin Ide Wheeler, president of the University of California, and loyally served by seventeen thousand alumni throughout the West, the Journal of Electricity feels honored in recording you among one of the engineers enrolled as a Builder of the West.

The San Francisco Electrical Development and Jovian League

The meeting of the League on Wednesday, February 28, was devoted to the subject of accountancy which was the text of an address by C. C. Staehling of the College of Commerce at the University of California. The speaker brought out the necessity of proper accounting and cost keeping for the man engaged in the electrical business and was intently followed by an unusual number of electrical contractors present at the meeting.

On Wednesday, March 7, M. S. Orrick of the Western Electric Company acted as chairman of the day who introduced P. L. Thompson, advertising manager for the Western Electric Company, as speaker of the day. Mr. Thompson spoke in an interesting and instructive manner concerning the manner of selling an idea in the electrical business and illustrated his points by exhibiting several slides which set forth the arguments now being used by his company in advertising the electrical idea throughout the nation.

California Section of Electrical Inspectors

The regular monthly meeting of the California Section of the National Association of Electrical Inspectors was held Saturday, March 3d, in the Merchants' Exchange Building. There was a large attendance of members and a number of representatives of the various manufacturing, jobbing and engineering concerns as guests. Nearly the entire afternoon was devoted to a study of the California Electrical Utilization Safety Orders and particularly to the proposed changes in Order 703 (C-3), Grounding, and 737, Disconnection of Fusible Cutouts Before Handling, both of which were brought up for revision at a public hearing held on Friday, March 9th, in San Francisco and on Monday, March 12th, in Los Angeles.

Members were unanimous in the approval of the new proposed order covering grounding, believing that the wire sizes selected are ample for complete protection and at the

same time will permit of a lower cost for ground protection. It was suggested, however, that the range in amperes for the various sizes of ground conductors specified should agree with the maximum ampere capacity of the various standard cutout blocks, that is, the first proposed range 0 to 50 amperes should be changed to read 0 to 60 amperes, the second 61 to 100 amperes and so on, the theory being that any cutout in the system is likely to be fused to its maximum capacity. This is a good suggestion. It should be adopted.

In their discussion of the proposed changes in Order 737 both sections (a) and (b) as revised were accepted as being desirable. Paragraph (a) provides for a switch in all main circuits and branch circuits, except branch lighting circuits, for the purpose of disconnecting the fuses from all sources of electrical energy when the cutout is being re-fused. Paragraph (b) of the same order as revised provides for a switch where the current of a single circuit is separately metered, as in apartment houses, etc.

However, in the discussion of paragraphs (c) and (d) of this same order as revised, there was much diversity of opinion and no final interpretation was accepted. There was a general feeling that paragraph (d) calls for certain types of switches which are not now available in the market except in very limited numbers and these are offered by only one or two manufacturers. It was pointed out that the various manufacturers of switches are not now in a position to develop immediately lines of switches that will meet these requirements. Further, they do not wish to proceed with these developments until such time as several other States now considering the adoption of the Bureau of Standards Code, at least in part, have arrived at some standard.

It was also suggested that future revisions of the orders should be written with the greatest care to eliminate all possible chances of misunderstanding regarding their interpretation. Your correspondent agrees heartily with this suggestion. Many of the orders, as they now read, are not sufficiently clear, and it would seem that written interpretations of the various orders sent out from time to time by the commission to the various inspection bureaus and others interested would be very helpful. It is hoped that the commission will take steps to do this in the near future.

The following members were present:

W. E. Brothers, chief electrical department, Berkeley.
G. A. Cleary, electrical inspector, Board of Fire Underwriters, San Francisco.
F. R. Ellison, electrical inspector, Dept. of Elec., Oakland.
B. C. Hill, supervisoral inspector, Dept. of Elec., Oakland.
H. Abernathy, East Oakland.
G. M. Hodgkins, electrical inspector, Dept. of Elec., Oakland.
C. W. Mitchell, E. E. Board of Fire Underwriters, San Francisco.
W. A. Murphy, chief Department of Electricity, Stockton.
M. C. Sandles, electrical inspector, Dept. of Elec., Oakland.
P. Anderson, electrical inspector, Dept. of Elec., Oakland.
A. V. Youens, electrical department, Palo Alto.
L. Wierda, electrical inspector, Richmond.
J. I. Dixon, city electrician, Santa Clara.
A. Kempston, superintendent fire alarms, City of San Francisco.
W. Pennycook, electrical inspector, Dept of Elec., San Francisco.
T. M. Robinson, city electrician, Fresno.
W. A. Spencer, city electrician, San Jose.

Oregon Association of Electrical Contractors and Dealers

The Oregon Association of Electrical Contractors & Dealers, held its quarterly meeting at Portland, Oregon on February 21, 1917. This meeting was the largest affair ever held in the history of the present association.

At noon an executive meeting was held at the chamber of commerce at which the entire executive committee met with all of the out of town members and the local jobbers, at which time the state of the organization was fully discussed, and after which William Bristol addressed the meeting at length.

At 3:30 p. m. the meeting was adjourned and the visiting members were assigned to autos and driven for a trip over the Columbia River Highway, after which they were taken to the Crown Point Chelat, where they were soon joined by a large number of electrical men from Portland, and other cities.

California Association of Electrical Contractors and Dealers

The regular monthly meeting of the Association was held at Sacramento February 24th, with a large and enthusiastic attendance. The principle business transacted at the afternoon meeting was a discussion of the question of "Trade Acceptances"—whether they should be endorsed and adopted by the contractors. As a great diversity of views existed, a special committee consisting of H. C. Reid, T. E. Bennett and C. F. Butte was appointed to report with recommendations at the next business meeting. W. D. Kohlwey made a strong plea for a greater membership of California contractors in the national organization. This matter was referred to a committee consisting of Frank Watts, P. Decker and J. Hetty. It was decided to hold the annual convention in July at Santa Rosa. The convention committee consists of W. E. Hayes, E. E. Browne and M. A. De Lew.

At the joint dinner of the jobbers and contractors in the evening A. E. Brockway presided as toastmaster. After a brief word of welcome he called on M. A. De Lew to report on the progress of the San Francisco Section. After tracing the early efforts of the local and giving a glowing tribute to W. L. Goodwin, Mr. De Lew discussed integrity as the one basis for successful organization.

J. C. Hobrecht then gave a general talk on what was wrong with the electrical industry, his conclusion being ignorance of business methods by the contractor and the extension of long credits by the jobber. He showed where the contractor was too willing to sacrifice profit in order to beat a competitor to a job. The average dealer is more of a mechanic than a business man and does not realize that his work must always be done at a profit. He seldom has enough capital to carry him through and fails to recognize the necessity for taking care of the overhead. Inasmuch as the jobber's prosperity is dependent upon the dealer's prosperity this becomes a problem for the jobber to consider. He stated that in the other lines of business, as in the electrical industry, 55 per cent of sales are due to the dealer's influence, the other 45 per cent being traced to advertising. He said that the jobber should not only see that the dealer is able to pay for the goods he orders but should also investigate his financial ability to carry out the work he starts. Easy credit from a jobber encourages men with insufficient capital to take up contracting work to the detriment of the established dealers. Furthermore, the central station should take an active interest in the dealers' welfare as it needs the co-operation of both the jobber and the contractor.

D. E. Harris, in analyzing the factors that contribute to business success, stated the necessity for co-operation between capital, as represented by the manufacturer and jobber, labor, as represented by the contractor, and the consumer, as represented by the general public. He showed that rivalry without co-operation means reckless competition. He stated the jobbers are studying how to improve conditions and realize the necessity for mutual co-operation. He presented figures showing that more than half the orders filled by jobbers are for less than $5 and suggested that both the jobber and the dealer would save money by a bunching of orders.

A. H. Halloran explained the aims and purpose of the new Pacific Coast Section of the National Electric Light Association, comprising the central stations in California, Nevada, Arizona and New Mexico. He detailed the methods of working and talked of the division of association activities into engineering, accounting and commercial lines. By a recent ruling there will be adequate representation of the contractor, jobber and manufacturer on the executive committee and especial attention is to be paid to co-operative methods of appliance merchandising. He urged that the contractor co-operate with this new organization.

C. F. Butte, spoke of the relation of the electrical business with allied industries, such as plumbing and steam fitting. He showed that a profit of 25 and 20 gives only 11 1/3 per cent and urged that all business be done at least on this margin. He also suggested more close affiliation with the National Electric Contractors' Association and briefly outlined the plans of the Western Conference Board. He stated that affiliation with the commercial section of the National Electric Light Association should bear good fruit for the contractor.

L. H. Newbert told of the ways in which the Pacific Gas & Electric Company was encouraging the contractor-dealer, particularly as regards the discontinuance of house wiring and the sale of lamp socket appliances. The policy of his company is to give the dealers an opportunity to sell wherever they will take advantage of it. They are willing to assist the contractors in every way in the upbuilding of their association.

Henry Holland stated the Great Western Power Company was ready to join the association and willing to co-operate with the contractor.

Brief remarks were also made by G. B. Baldwin, T. J. Dunn, M. S. Orrick, F. J. Cram and H. C. Reid, who spoke on the progress that has already been made by the association and their future intentions as regards sales campaign, credit betterment and the distribution of information. R. Goold, J. Gensler and H. H. Courtwright told what was being done by the several local associations and the parting words were given by President Somers.

The following were in attendance:

Jefferson W. Asher, Asher Electric Co., San Francisco.
T. E. Bennett, Rex Electric Co.
C. W. Beaton, City Electrician, Sacramento.
B. B. Baldwin, Pacific Gas & Electric Co., Sacramento.
A. E. Brockway, Latourrette-Fical Co., Sacramento.
E. E. Browne, H. S. Tittle Co., San Francisco.
C. F. Butte, Butte Engineering & Elec. Co., San Francisco.
California Mech. & Electric Co., Sacramento.
H. H. Courtwright, Valley Elec. Supply Co., Fresno.
H. A. Case, Western Electric Co.
F. J. Cram, Electric Appliance Co., San Francisco.
C. L. Chamblin, California Electric & Const. Co., San Francisco.
M. A. De Lew, San Francisco.
P. Decker, Decker Electric Co., San Francisco.
T. J. Dunn, Great Western Power Co., Sacramento.
Electric Machinery Equipment Co.
C. A. Felix, Great Western Power Co., Sacramento.
M. Flatland, Globe Elec. Co., San Francisco.
J. Gensler, Elec. Const. Co.
R. Goold, Goold & Johns, Stockton.
H. H. Hoxie, Elec. Ry. & Mfgrs. Supply Co., San Francisco.
B. G. Hannon, Great Western Power Co., Sacramento.
J. C. Hobrecht, J. C. Hobrecht Co., Sacramento.
A. H. Halloran, Journal of Electricity, San Francisco.
M. E. Hickox, Pacific States Electric Co., San Francisco.
Wm. Hemington, City Protective Electric.
D. E. Harris, Pacific States Electric Co., San Francisco.
C. E. Hall, Great Western Power Company.
Henry Holland, Great Western Power Co.
D. E. Johns, Goold & Johns, Stockton.
Frank Kiliam, Pacific States Electric & Mfg. Co., San Francisco.
C. B. Kenney, Ne Page-McKenny Co., San Francisco.
R. King, King Electric Co.
W. D. Kohlwey, Kohlwey, Smith, Alfs, San Francisco.
G. J. King, Oakland.
F. C. Libby, Scott, Lyman & Stack, Sacramento.
W. B. Lewis, Western Electric, Sacramento.
F. C. Lyman, Secretary, Stockton-Local, Stockton.
C. A. Lamus, Graham & Lamus Co., Sacramento.
C. W. McKillup, Pacific Gas & Electric Co., Sacramento.
F. H. Mills, Electric Appliance Co., San Francisco.
F. E. Newbery Electric Co.
Nevada Electric Co., Sacramento.
Lee H. Newbert, Pacific Gas & Electric Co., San Francisco.
M. S. Orrick, Western Electric Co., San Francisco.
A. P. Peck, Holabird-Reynolds Electric Co.
H. C. Reid, Pacific Fire Extinguisher Co., San Francisco.
Standard Electric Works, Sacramento.
H. T. Schultz, Electric Appliance Co.
Frank J. Somers, San Jose, Cal.
T. Scott, Scott, Lyman & Stack.
C. J. Thelen, Electric Rwy. & Mfgrs Supply Co.
F. Waxon, Waxon Bros.
Carl F. Wolf, Standard Elec. Construction Co., San Francisco.
Frank W. Watts, McFell Electric Co., San Francisco.
Western Gas & Electric Appliance Co., Chico.
Wallace & Smith, Lodi.
A. Youngholm, Electric Rwy. & Mfgrs. Supply Co.

NOTES OF CALIFORNIA WATER COMMISSION

Ed Fletcher of San Diego has applied for 30 cu. ft. per second of the waters of Santa Ysabel Creek and Black Canyon Creek, tributary to the Santa Ysabel River, in San Diego County, for the development of hydroelectric power for commercial use. Data filed with the application specifies a pipe line five miles long with a feeder from Black Canyon over a mile in length. The diversion from Santa Ysabel Creek is proposed by means of a dam, which shall also be a storage dam, to be 110 ft. high, 800 ft. long on top, 150 ft. long on bottom, of concrete, multiple type, capable of holding back 11,865 acre feet of water. The diversion dam in Black Canyon Creek is specified as a small concrete structure 5 ft high, 10 ft. long on top and 3 ft. on bottom. The total fall to be utilized is given as 890 ft. and the amount of theoretical horsepower to be developed as 3000. The estimated cost is $350,000.

Byron D. Beckwith of Colusa, 40 cu. ft. per second of the waters of the Sacramento River for the irrigation of rice, alfalfa and orchard. By means of a main canal four miles long it is intended to convey the water to 2000 acres of land.

Chas. W. Guerin of Pomona—150,000 acre feet per annum of the waters of Whitney Creek, tributary to the South Fork of Kern River in Tulare County for the purpose of irrigating lands in the Inyo-Kern Valley. The application specifies a proposed canal and pipe line 45 miles long, the project to be known as the Monache Reservoir and Inyo-Kern Canal. The data concerning the project is incomplete and the commission has given applicant until December 1 to complete the application.

The city of Los Angeles—500 cubic feet per second of the waters of Owens River for power purposes. This application is for one of the units of the proposed general power project for supplying the city of Los Angeles with light and power. There are three plants included in this application In Plant No. 1, the water is taken in a large measure from the city's Long Valley Reservoir site. The main dam specifications, as proposed, provide for a structure 150 ft. high, 520 ft. long on top and 130 on bottom of hydraulic fill with concrete core wall. The dams for the other two plants are low concrete structures. The total fall to be utilized by each plant is as follows: No. 1, 1101 ft.; No. 2, 829 ft.; No. 3, 384 ft. The power it is proposed to generate at each is as follows: No. 1, 41,000 theoretical horsepower; No. 2, 34,000; No. 3. 15,000. All water is to be returned to Owens River after being utilized for power. The cost of this unit is given in the application of $7,500,000.

In still another application Los Angeles asks for 250 cubic feet per second of the waters of the south fork of the Kern River in Tulare County for the same purpose as above. The application states that it is proposed to construct a diversion dam 20 feet high, 200 feet long on top and 50 feet on bottom of timber crib construction with earth fill and metal gates set in concrete, with 13½ miles of conduit, tunnel and pipe line, the works to be known as Kern River No. 2 Power Project.

Charles K. Fox of Pomona—500 cubic feet per second of the waters of Twelve Mile Creek, 100 of Keeno Creek, 250 of Bidwell Creek and 500 of Cowhead Lake in Modoc County for irrigation. The application specifies the storage of 117,000 acre feet of water in Cowhead Lake and the irrigation of 40,000 acses of land at an estimated cost for the entire project of $800,000.

Mono Mutual Water Company of San Francisco—Incorporated December 29, 1916; 400 cubic feet per second of the waters of Rush Creek and 350 of Levining Creek tributary to Mono Lake in Mono county for irrigation and domestic purposes. The application states that there will be a canal 30 miles long to be known as the Mono canal, for the irrigation of 50,000 acres at an estimated cost of $500,000.

WHAT WESTERN INVENTORS ARE DOING

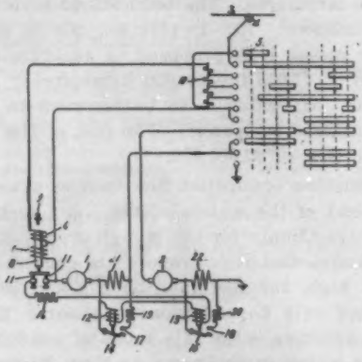
(The insulator, the dam, and even the fish-stop play important roles in Western hydroelectric practice. Below will be found briefly described recent patents that have been granted to Western inventors for improvements along these lines. Motor control and electric house-heating furnaces, much needed improvements in utilization of electrical energy, also come in for brief descriptions.—The Editor.)

1,215,549. **Electric-Conductor-Insulating Support.** John A. Koontz, Jr., Palo Alto, Cal., assignor of one-half to Edward W. Beardsley, San Francisco, Cal., and one-fourth to Richard W. Shoemaker, Alameda, Cal.

An electric-conductor-insulating support, comprising a plurality of interconnected insulating units, and a hollow metallic disk interposed between two adjacent insulating units for increasing the electrostatic capacity thereof.

1,216,126. **Motor-Control System.** William P. Jackson, Oakland, Cal., assignor to General Electric Company, a corporation, of New York.

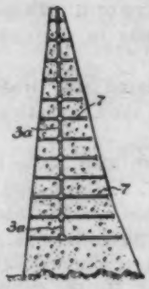
A motor-control system of a motor having a series field, a source of current for the motor, a starting resistance for the motor, means for connecting the starting resistance in series with the motor and for cutting the same out of circuit,



means for reducing the field strength of the motor, means responsive to the current in the motor circuit for operatively connecting the field reducing means in shunt to the motor armature when the current in the motor circuit falls to predetermined value, and means responsive to the current through the starting resistance for preventing the connection of the field reducing means in shunt to the motor armature until the starting resistance has been cut out of circuit.

1,216,234. **Dam Construction.** Lars R. Jorgensen, South Berkeley, Cal.

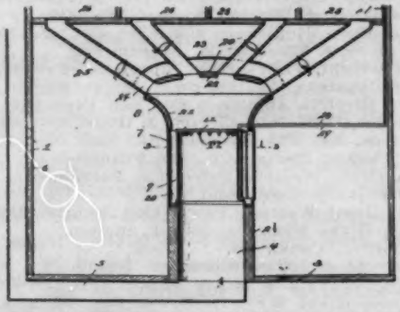
A dam body having grout pipes inserted in the contraction joints and distributed over the whole section, the ends of these pipes preferably flattened to form a slot and the sides of the pipes provided with short longitudinal slots at spaced intervals, these permanent pipes having movable pipes of smaller diameter inserted, the space between the two pipes being made tight at the lower end of the movable pipe by means of a packing, and the lower end of the movable



pipe serving as a discharge for the grout into the large pipe and the upper end being connected to a grout pump.

1,216,101. **Electric House-Heating Furnace.** August C. Fingerle, Modesto, Cal.

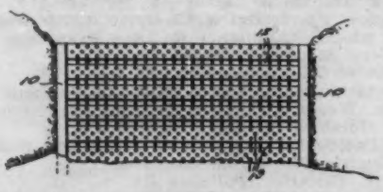
An electric furnace comprising a chamber for the passage of air to be heated, air-heating means embodying a plate



composed of heat-radiating material arranged at the top of the chamber and having on its under side electric heating means for generating and radiating heat downwardly to heat the air in the chamber, and a dome arranged above the plate to receive and distribute the heated air from the chamber.

1,215,781. **Fish-Stop.** Frank H. Davis, Eugene, Ore.

A ditch guard comprising posts provided with set or vertically extending grooves, baffle plates positioned in one set of grooves in superposed relation and provided with openings forming passageways, baffle plates positioned in the second set of grooves in superposed relation and in staggered



relation to the first set of baffle plates and provided with openings forming passageways, and legs extending from each baffle plate to engage the next lower plate and hold the plates of each set in spaced relation.

LATEST IN EVERYTHING ELECTRICAL

(The latest in everything electrical since the last date of publication is the announcement of the consolidation of the McGraw and Hill Publishing Companies given below. New apparatus comes in for its share of discussion in the way of fan motors for the coming summer, and the electrically operated sewing machine. Other interesting items also may be noted in the following pages.—The Editor.)

TYPICAL FANS FOR SUMMER

The early approach of summer sunshine on the Pacific Coast brings visions of possible future uses for the electric fan. Here are typical designs that may be obtained on the market. Most of the types listed are practically identical with those of last season, only such changes as engineering experience has shown advisable having been made.

The 9 in. fans were especially designed to meet the demands of those who consider the 8 in. fan too small for effective service.

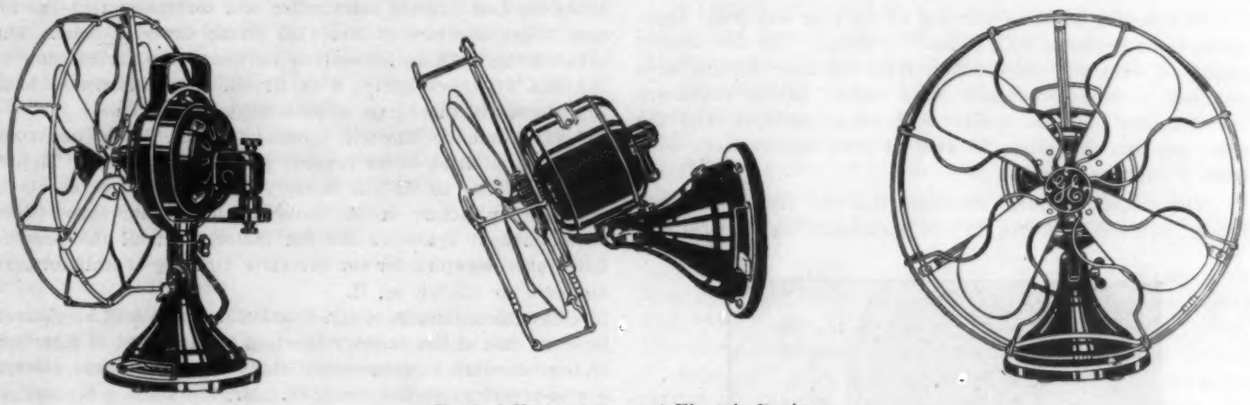
All 9 in., 12 in. and 16 in. fans are arranged for two or three operating speeds with "off" position. The control switch, which is mounted in the base, is of the improved lever design with notched guide, insuring a positive setting for each speed.

Non-Oscillating Electric Fans.—The 12 in. and 16 in. designs have swivel and hinge joint mounting, permitting the movement of the fan horizontally or vertically through a wide angle. The ease of conversion from desk to bracket type is a notable feature. This type of fan is extremely popular because of its universal adjustments. The 9 in. fans have a hinged mounting only; the swivel feature is omitted because of the extreme lightness of the fan.

Oscillating Electric Fans.—The reduction mechanism of the oscillating fan is enclosed in a dustproof cast iron box mounted on the rear cap. The crank disk operated by the slow speed shaft, which projects through the lower section of the gear box, carries the connecting rod. This rod swings at one end upon a stud fastened to the stationary support and at the other end upon a crank pin, which is adjustable with relation to the center of the crank disk.

The upper adjusting nut, which throws the oscillator "in" and out," and the lower adjusting nut, which changes the arc of oscillation, are easily actuated while the fan is in operation, and each produces a definite result. An additional adjustment in the pedestal permits swiveling the ring mounting for fan body and therefore the center of oscillation within a range of 90 deg. Thus the oscillator, having a maximum stroke of 90 deg., and a swivel adjustment of 90 deg., may be adjusted to any point within an arc of 180 deg.

Residence Fans.—The residence fan is designed for extreme quietness in running. It differs from the corresponding standard designs only in having a slow-speed operating characteristic and a 6-blade fan. This type of fan has a wide field of usefulness in residences, hospitals, offices, theaters, etc.



Typical Fans of General Electric Design

Ventilating Outfits.—The necessity of ventilation in small apartments is often greater than in large ones, hence the demand for the 12 in. and 16 in. exhaust fans. These are easily installed, and are durable and efficient. They are adapted to small industrial establishments, restaurants, grill rooms, kitchens, laboratories, lavatories, vaults, etc.

Ceiling Fans.—The ceiling fan is universally employed in locations where the moving of a very large volume of air at a moderate velocity is desired. It is suitable for large offices, stores, restaurants and theaters.

Ornamental type ceiling fans will no longer be carried as standard.

Typical Fans of Westinghouse Design

McGRAW AND HILL PUBLISHING COMPANIES CONSOLIDATE

The McGraw Publishing Company, Inc., and the Hill Publishing Company, New York, have been consolidated as the McGraw-Hill Publishing Company, Inc. The new company acquires all the properties and interests of the two constituents, including the following technical journals.

Electrical World, Electrical Railway Journal, Electrical Merchandising, Engineering Record, Metallurgical and Chemical Engineering, the Contractor, American Machinist, Power, Engineering News, Engineering and Mining Journal, and Coal Age.

Two of these papers, Engineering News and Engineering Record will be consolidated under the name, Engineering News-Record, with Mr. Charles Whiting Baker, now editor of Engineering News, as editor-in-chief.

Mr. James H. McGraw will be president of the new company, Mr. Arthur J. Baldwin (now president of the Hill Publishing Company), vice-president and treasurer, and Mr. E. J. Mehren, vice-president and general manager.

NEW WESTINGHOUSE SEW-MOTOR

The sewing machine was one of the first household appliances to be equipped with an electric motor. The first motors employed were just the ordinary type, but later designs have resulted in the development of a motor, having necessary speed control, for use solely on sewing machines, and the efficiency and operating features of such motors have been greatly improved.

The latest and most desirable features are to be found in the Sew-Motor shown in the accompanying illustrations,

The New Westinghouse Sew-Motor

which has just been placed on the market by the Westinghouse Electric & Manufacturing Company.

The Sew-Motor can be readily attached to any make of stationary or drop-head sewing machines, new or old, with the exception of a few obsolete models. When not in use, the motor if mounted on a stationary head machine, can be pushed back out of the way and the cover put on, or dropped from the head if used on modern types of drop-head machines. When desired, however, the motor can be removed readily by loosening one thumb screw as it is light and portable.

NEW BULLETINS

The recommendations of the electrical committee of the National Fire Protection Association, at its twenty-first annual meeting, covering thirty-one pages of matter, are now available in published form.

The Locke Insulator Manufacturing Company has just issued supplement No. 1 to the beautifully engraved Insulator Book which made its appearance to the trade some months back. The supplement contains ten designs of insulators for voltages ranging from 27,000 to 80,000.

ERRATA IN NOTICE FOR NEW POWER FACTOR CALCULATOR

In the March 1st issue of the Journal, an article and a cut of a new power factor calculator by Messrs. Backstrand and Hoag of Riverside was shown. An error was made in that the device was called a power factor meter instead of a power factor calculator. The device is a calculator and not a meter.

TRADE NOTES

The Wagner Electric Manufacturing Company has combined its Los Angeles sales office and service station in new and larger quarters at No. 1320 South Grand avenue. The organization will as heretofore be under the jurisdiction of the San Francisco office, with Mr. H. W. Doubrava as local representative in charge of both sales and service.

The Moloney Electric Company of St. Louis has completed an addition to its present plant. This addition is just twice as large as its old factory, and in addition to this it has another factory at St. Louis which contains three times as much floor space as the old factory. In all the present floor space occupied for the exclusive building of transformers amounts to 128,000 sq. ft.

The many friends of Mr. Charles J. Marsh will be pleased to learn that at the January meeting of the board of directors of the Standard Underground Cable Company he was elected a vice-president of the company. Mr. Marsh is a brother of Mr. Joseph W. Marsh, president of the company. He has for many years been manager of the Eastern and Northeastern sales departments and also principal Eastern metal buyer, with headquarters in New York, and this promotion is a well-earned reward for faithful and meritorious service. He will continue to have his headquarters in New York and to exercise general supervision over the sales territory in which his genial character and native ability have won him and his company so many friends.

CALIFORNIA STATE CIVIL SERVICE COMMISSION

The California State Civil Service Commission announces an examination for mechanical inspector, State Department of Engineering, to be held in Sacramento, San Francisco and Los Angeles, March 24, 1917, to provide a register of eligibles from which to fill positions with the State Department of Engineering. The salary range is from $150 to $200 a month. The duties of the position include the supervision of either contract or day labor work on heating, ventilating, plumbing and similar work in building construction.

UNITED STATES CIVIL SERVICE EXAMINATION

The United States Civil Service Commission announces an open competitive examination for mechanical engineer, qualified as inspector of gauges, for men only. A vacancy at the Frankford Arsenal, Philadelphia, Pa., at an entrance salary of $2000 to $2400 a year, and future vacancies requiring similar qualifications will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

NEW ELECTRICAL DEVELOPMENTS

(The most interesting and important items of the past two-week period in new electrical developments are to be found in the financial statements below. The statement of the Pacific Gas & Electric Company showing that dividends have been earned on the preferred stock more than three times over with a margin of safety of nearly three millions is indicative of the splendid financial status of Western power companies. Other items of interest in electrical development follow.—The Editor.)

FINANCIAL

SAN FRANCISCO, CAL.—The Coast Counties Gas & Electric Company has reported to the National City Company for the year 1916, showing a surplus of $88,385 on the $61,000 first preferred, this being at the rate of 8.47 per cent on the $1,000,000 second preferred. The detailed statement compares as follows:

	1916.	1915.
Gross earnings	$361,408	$338 210
Operating expense, maintenance and tax	196,407	175,001
Net income	168,001	163,209
Bond interest	67,622	68,542
Deb. and other interest	11,994	15,466
Balance	88,385	79,201

SAN FRANCISCO, CAL.—The Great Western Power Company shows latest earnings, gross, $4,069,989; net $2,739,943; bond interest, $1,290,202; debenture interest, $300,000; guaranteed dividends, $150,000. In 1914 the gross was $2,888,940 and the net $2,015,177; in 1915 the gross $3,244,537 and net $2,289,198. Few companies in the United States are experiencing a more rapid and healthy growth. Among the underlying and subsidiary bonds outstanding are City Electric Company 5s, quoted around 90; California Electric Generating 5s, around 90; Central Oakland L. & P. 5s, around 90; Consumers' L. & P. 6s, around 100; Cons. Elec. 5s, around 79. All these issues are either assumed or guaranteed by the Great Western Power.

LOS ANGELES, CAL.—A meeting of the stockholders of the San Joaquin Light & Power Corporation, will be held April 20th, at the office of the corporation, room 805 Garland Building, for the object and purpose of determining whether additional bonded indebtedness in the sum of $4,500,000 shall be created by the issuance of its debentures to that amount to provide money to be used for new construction forming part of the corporation's system, additions, betterments and extensions, etc. Said debentures are to bear interest at a rate not exceeding 6 per cent per annum, payable semi-annually or quarterly, as may be determined by the stockholders' meeting or by the board of directors of the corporation. This notice is given by the direction of the board of directors of the San Joaquin Light & Power Corporation.

SAN FRANCISCO, CAL.—During the year 1916 the Pacific Gas & Electric Company, earned a surplus of $4,272,343 after the payment of all operating expenses and taxes, and setting aside $2,603,115 for maintenance, depreciation, uncollectable accounts, and for other contingencies. Dividends on the company's preferred stock, having the first claim on this surplus, amounted to $1,390,257, indicating that these dividends were earned more than three times with a margin of safety of $2,882,086. In the month of January, 1917, the company made a net gain of 1355 customers, and at the close of that month was serving 423,149 consumers. The magnitude of this list of customers may be appreciated from the fact that it exceeds the population at the 1910 census of each of ten States.

INCORPORATIONS

RENO, NEV.—Western Gas & Power Company, Reno, $1,000,000, shares $100 each, by C. S. S. Forney B. F. Silverstein, C. J. Parks, A. L. Erb and Lon Claybaugh, all of San Francisco.

ILLUMINATION

SAN DIEGO, CAL.—Machinery has been received here for the installation of the Ensenada electric lighting plant.

ORANGE, CAL.—The Merchants' & Manufacturers' Association is taking an interest in getting ornamental lighting system for the city.

FILLMORE, CAL.—It is probable that the main business block in Central avenue will be illuminated soon by ornamental lights.

HUNTINGTON BEACH, CAL.—At a session of the city trustees the petition of property owners asking for the installation of gas lights on Main street was granted.

SAWTELLE, CAL.—Bids for supplying and furnishing the city of Beverly Hills with 312 ornamental concrete lighting standards are being received by the city clerk.

ST. JOHNS, ARIZ.—Thos. W. Carraway has the contract for putting in the power plant for the Nebo Electric Light & Power Company. Work will be started at once.

HELIX, ORE.—At the meeting of the new council board, a committee was appointed to investigate the feasibility of putting in a municipal water plant in connection with the water system.

TACOMA, WASH.—The Home Electric Company has been given the contract to furnish the city light department with 18,000 lbs. of No. 6 copper wire and 1000 lbs of No. 10. The price is $9097.

LOS ANGELES, CAL.—The request for furnishing equipment for the Graham Lighting District through the county mechanical department, has been granted by the board of supervisors.

MIAMI, ARIZ.—The Union Electric Company, doing a general electrical contracting business, has opened offices at the Lenord Music Company. G. L. Lenord and Reid Clark are members of the firm.

LOS ANGELES, CAL.—An order has been made by the board of supervisors requesting the chief mechanical engineer to prepare specifications for the installation of a lighting system in Athens Lighting District.

MARSHFIELD, ORE.—J. H. Levers is taking steps to secure for the city of Marshfield a municipal electric plant. His plan is to petition a call for an election to decide upon bonding the city for such a plant.

TUCSON, ARIZ.—Plans for the camp at the Stratton property include the building of a concrete reservoir. The machinery for developing the property will consist of compressor, boiler and an electric light plant.

MODESTO, CAL.—Bids will be received by the county clerk up to March 13th for furnishing necessary lamps, appliances and electricity required for lighting streets by means of 100 candlepower to be installed on certain streets.

ARCADIA, CAL.—The board of supervisors have decided to light First avenue from the Santa Fe railroad right of way to Anite avenue, by installation of 14 reinforced concrete ornamental street lighting standards, wires, lamps, etc.

VALLE VISTA, CAL.—The commercial agent of the Southern Sierras Power Company has been here in reference to the proposed extension of the distribution system for lighting purposes along Florida avenue, from the end of the present line to Valle Vista.

LOS ANGELES, CAL.—At a meeting of the city council a petition was received from Stevens-Turner Company asking that an ornamental lighting system be installed on Sierra Bonita avenue, between Hawthorne avenue and Sunset boulevard.

CASA GRANDE, ARIZ.—The city council has awarded the contract for building the municipal water and electric light system to the Schweitzer Machine Company of Tucson, on a bid of $25,029. Construction work will commence as soon as possible.

TOMBSTONE, ARIZ.—The city council has extended the franchise to E. L. Wright for an electric light plant at Tombstone on petition of J. M. Downey, who will immediately take steps for the erection of a $15,000 plant. Street lights will also be installed in the business district.

ROSEBURG, ORE.—Harry Gall, manager of the Douglas County Water & Light Company announced that work will begin soon on the erection of a concrete office building for the company. Plans for the building are completed and the contract for the construction will be let.

ALBANY, ORE.—The city council has passed a resolution asking the Oregon Power Company for a price on the water and light system owned in Albany, to be submitted not later than April 1. A committee from the council will go to Eugene to inspect and investigate the municipal plants there.

NORTH YAKIMA, WASH.—Application by the Pacific Power & Light Company for a 50-year franchise from the county for the erection of an electric pole line along the county roads in the vicinity of Granger has been presented to the county commissioners. No date has been set for further action.

LOS ANGELES, CAL.—Application has been made by the Beverly Hills Utilities Company to the board of trustees of Beverly Hills for the granting of a franchise to lay, maintain and operate a system of pipes and pipe lines in, under and along public streets, etc, of the city for the purpose of supplying gas.

SANTA BARBARA, CAL.—The lighting of State street, which is now assured from the beach to Sola street, should be extended along upper State street and De la Vina street, to the city limits and Garden and Los Olivos streets to the Mission, according to sentiment expressed at a meeting of the Commercial Club.

SOUTH PASADENA, CAL.—Indications are that work will begin soon on installing the ornamental lighting system on Mission street, from Fair Oaks to Meridian avenue. The contract, which was let to the Arizona-California Construction Company, which has gone bankrupt, has been turned over to the Jacobs Electric Company of this city.

NOGALES, ARIZ.—At a meeting of the Chamber of Commerce a committee was appointed to investigate and report back on the plan for street lighting, to be recommended to the town council for adoption. A plan has been submitted by the International Gas Company to light Grand avenue, Park street and Court street and Morley avenue.

YUMA, ARIZ.—Application has been made to the board of supervisors by Chas. H. Hosfold for a franchise to build, operate and maintain an electric light plant and build electric pole lines along, over and across public streets and alleys within the limits of the town of Parker. It is the intention of the Board to grant the franchise at the meeting of March 5th.

BAKERSFIELD, CAL.—The city council has instructed the city engineer to prepare plans and specifications for the installing of an electrolier lighting system along Chester avenue, between Fifteenth and Twentieth, and along Nineteenth, between M and F streets. The engineer's plans will provide for the installation of four 500 candlepower electroliers to the block on each side of the street.

TACOMA, WASH.—Five bids for $20,000 worth of incandescent electric lamps were referred to the council by the electric department because the bids were all alike. The bids were from the North Coast Electric Company, the General Electric Company, Western Electric Company, Fobes Supply Company, and the Home Electric Company. The council referred the matter back to the superintendent of the electric department and instructed him to use his own judgment.

RICHMOND, CAL.—The Merchants' Association of this city has started a campaign to have electroliers established in the business district. At a well attended meeting President Harry W. Pulse outlined the plan, which was unanimously indorsed and a committee consisting of C. M. Brewer, O. R. Ludewig, W. L. Ballemger, D. J. Collins, Charles J. Crary and President Pulse was appointed to figure out the plans with the city council.

TRANSMISSION

VACAVILLE, CAL.—The Vallejo Electric Light & Power Company has filed application for a franchise to erect and maintain power lines along certain public roads in Solano County. Bids will be received for the franchise until April 2.

RENO, NEV.—An electric generating plant developing 2500 h.p. will be constructed a short distance below Vista on the Truckee River as soon as the weather permits, according to plans that have been perfected by the Nevada Valleys Power Company.

HANFORD, CAL.—An ordinance has been passed granting the Mt. Whitney Power & Electric Company a 50-year franchise allowing it to construct and operate an electric light, heat and power system in Kings County. There was no other bidder for the franchise.

OAKDALE, CAL.—The Sierra & San Francisco Power Company is providing light and power for the plants of the Valley Ice Cream and the Borden Condensed Milk Company of Modesto. In the plans outlined by the company for improvement of its lines, is an appropriation of $10,000 for a plant to be erected at Oakdale.

LOS ANGELES, CAL.—To furnish the energy for the great mining projects of three states and eventually electricize the Santa Fe railroad, details for the building of a huge power dam in the Grand Canyon of the Colorado are completed. The plant is expected to furnish hydro-power for less than $4 per h.p. a month.

TELEPHONE AND TELEGRAPH

EUGENE, ORE.—The Postal Telegraph & Cable Company is asking the council for a franchise to operate in the city.

TOMBSTONE, ARIZ.—A new telephone system will be built at Johnson by the Mountain States Telephone & Telegraph Company.

COURTLAND, ARIZ.—District Manager Evans of the Mountain States Telephone Company has been here planning improvements in the local system of lines.

EUGENE, ORE.—The Pacific Telephone & Telegraph Company sent a crew of men to the coast to run a 24 mile 132 lb. double copper wire from Cushman to Gardiner. The new toll line will connect with the main wire running from Eugene to Florence.

YUMA, ARIZ.—It has become known that officials of the Mountain States Telephone & Telegraph Company have approved plans, estimates and specifications for the installation of telephone lines throughout Yuma Valley, and that as soon as the general manager at Denver signs the papers the work of construction will be commenced. The company has appropriated $25,000 for this enterprise. It includes the establishment of an exchange at Somerton.